La Niña On the Way Out and a Look Ahead to March, April and May 2011

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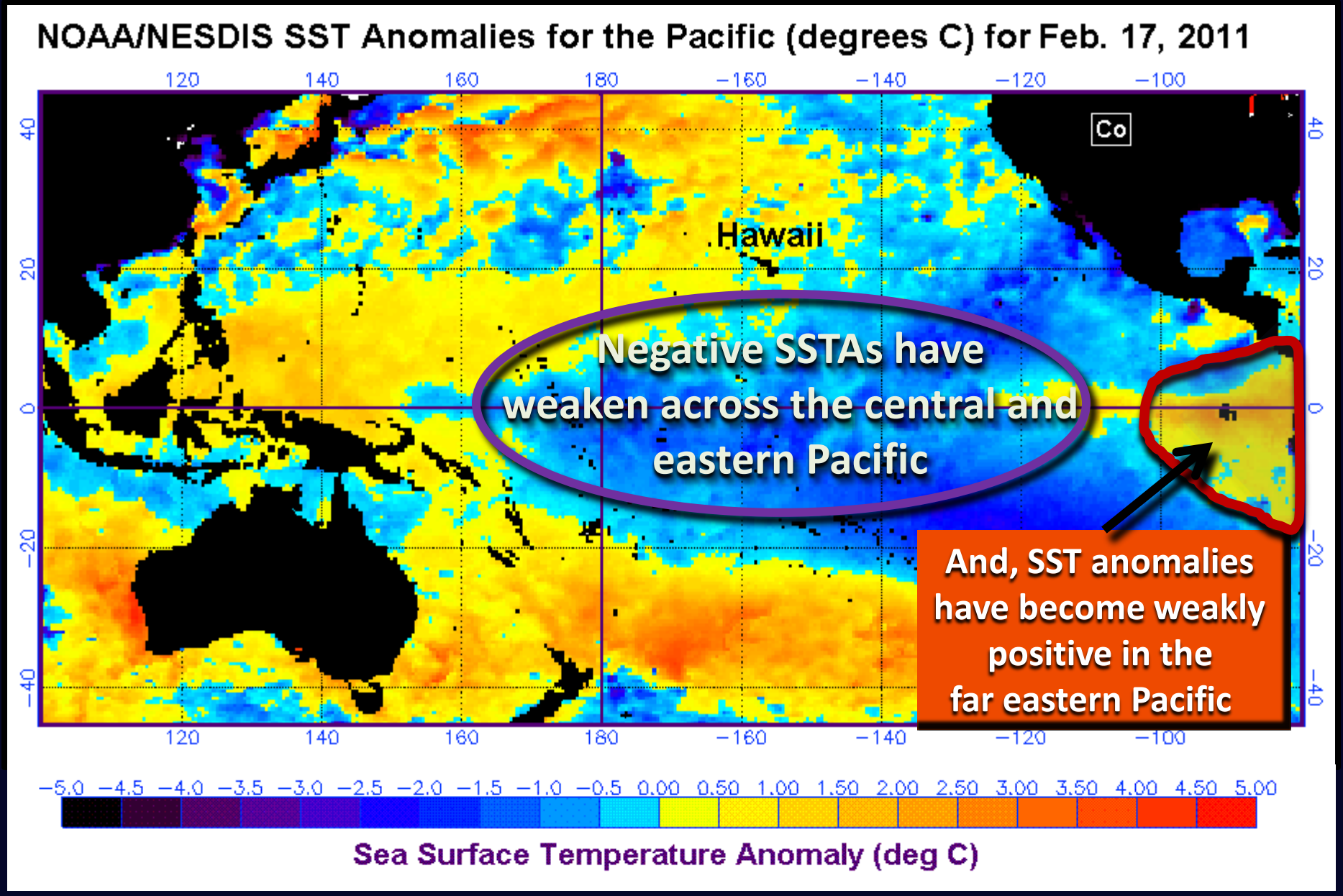
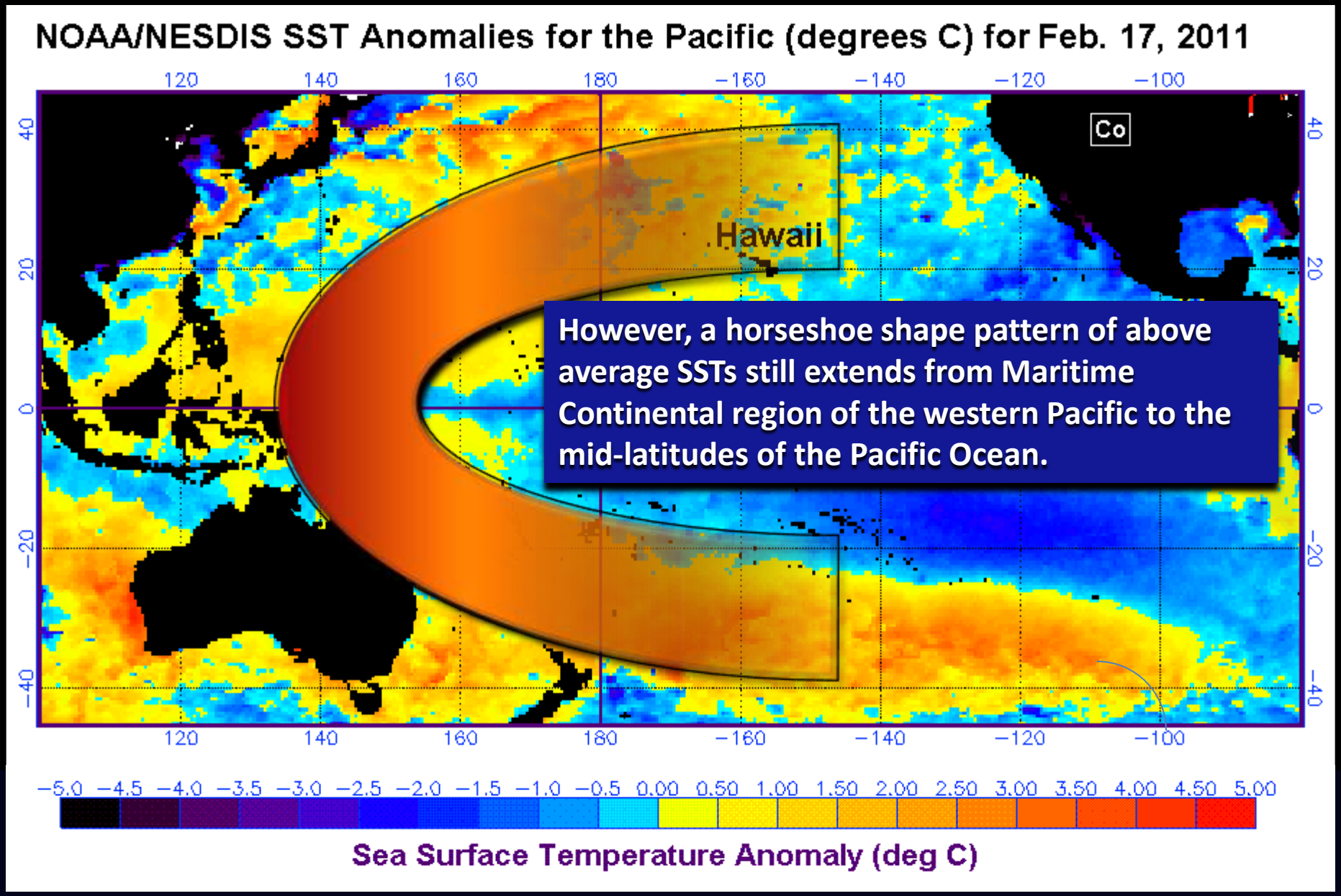
Preview

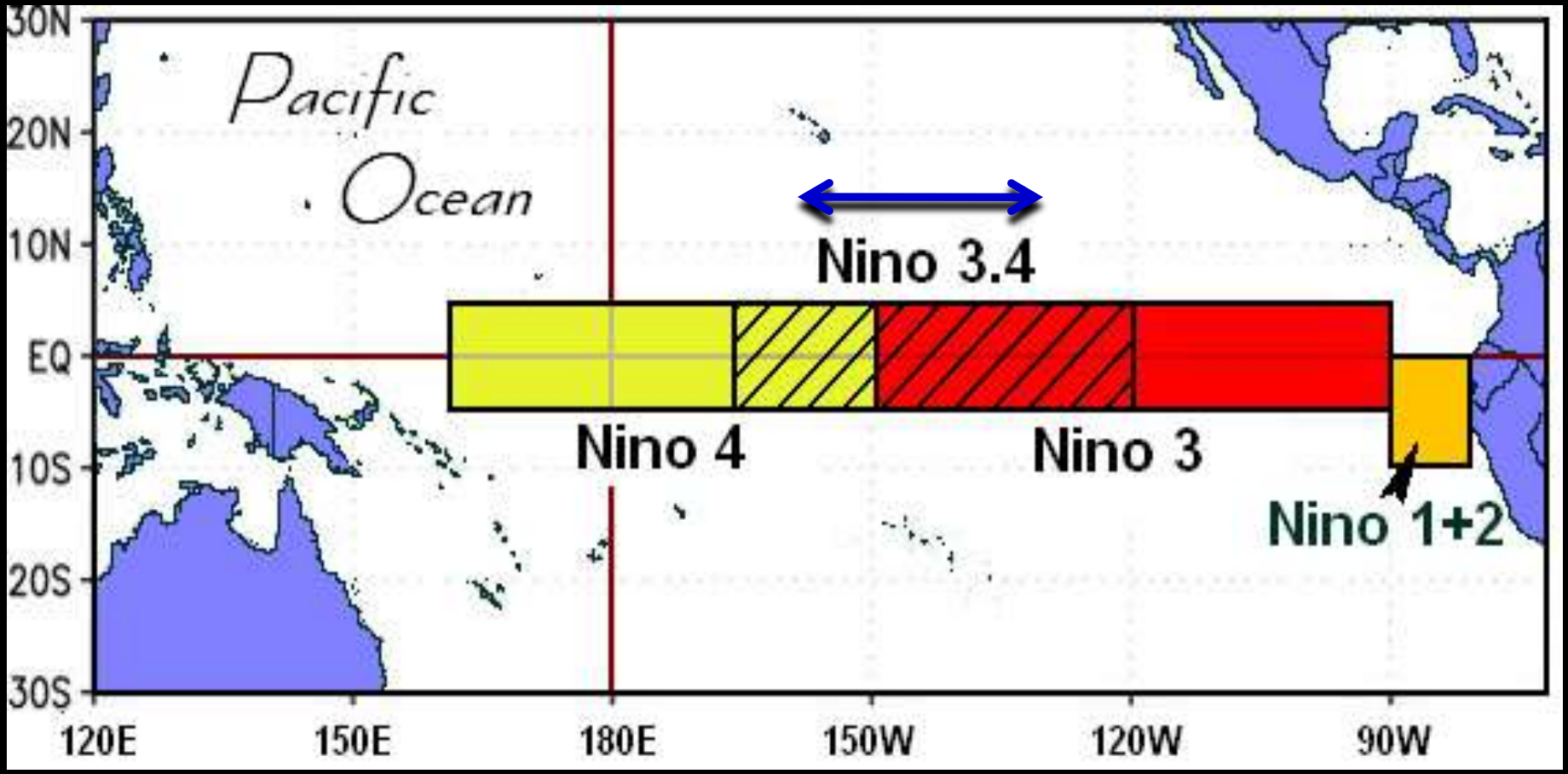
- The present La Niña is showing signs of weakening.
- Comparing this La Nina to earlier La Ninas of similar strength.
- A look back to the last 30 and 90 days.
- How La Niña and the Pacific jet stream may continue to influence Colorado weather during the next three months.
- The latest temperature and precipitation outlooks for Colorado from NOAA's Climate Prediction Center (CPC).


La Niña Showing
Signs of Weakening

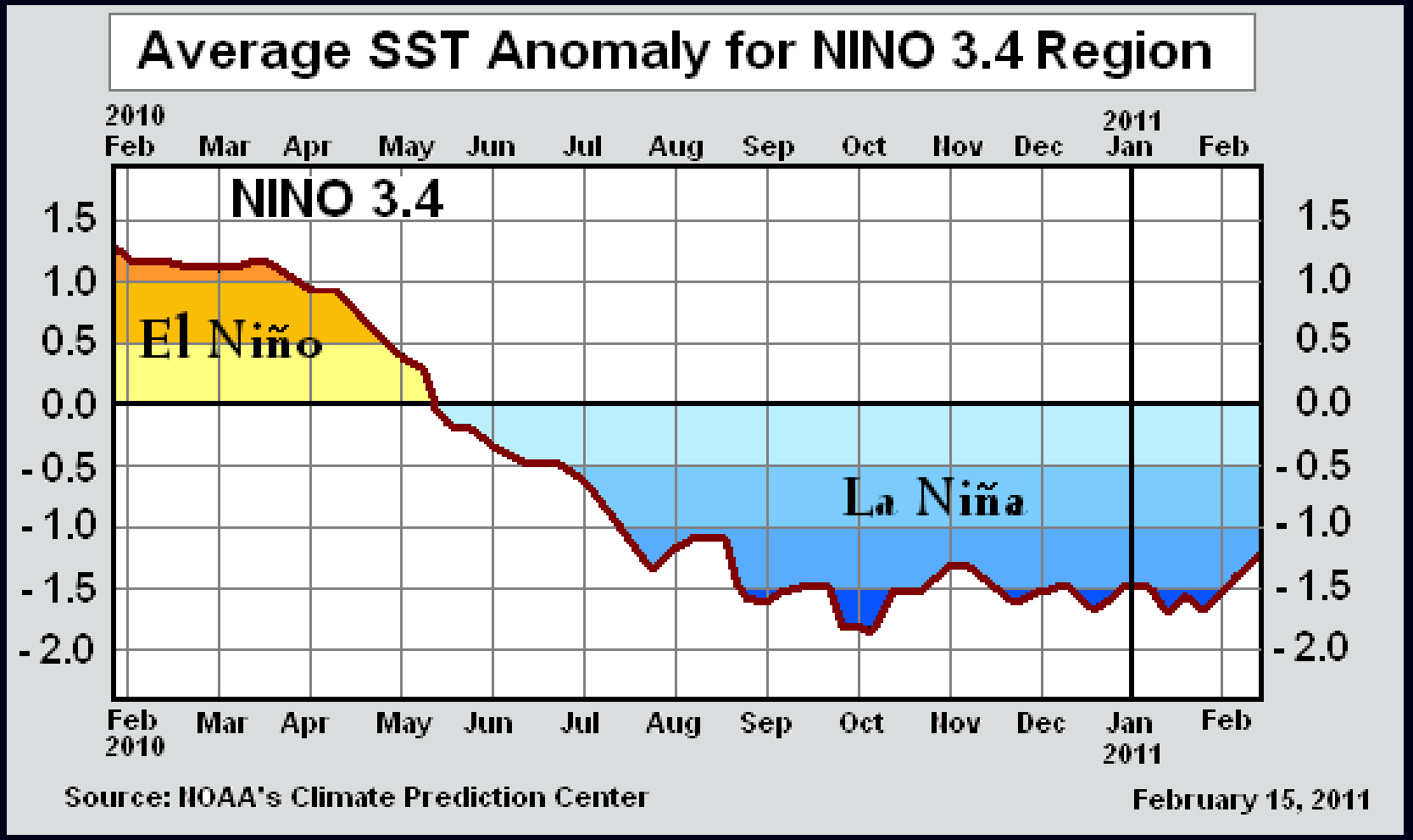

NOAA/NESDIS SST Anomalies for the Pacific (degrees C) for Feb. 17, 2011
120
140
160
180
−160
−140
−120
−100
40
20
0
−20
−40
Co
Hawaii
Negative SSTAs have weaken across the central and eastern Pacific
And, SST anomalies have become weakly positive in the far eastern Pacific
−5.0 −4.5 −4.0 −3.5 −3.0 −2.5 −2.0 −1.5 −1.0 −0.5 0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00
Sea Surface Temperature Anomaly (deg C)


NOAA/NESDIS SST Anomalies for the Pacific (degrees C) for Feb. 17, 2011
120 140 160 180 −160 −140 −120 −100
40 20 0 −20 −40
Co
Hawaii
However, a horseshoe shape pattern of above average SSTs still extends from Maritime Continental region of the western Pacific to the mid-latitudes of the Pacific Ocean.
−5.0 −4.5 −4.0 −3.5 −3.0 −2.5 −2.0 −1.5 −1.0 −0.5 0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00
Sea Surface Temperature Anomaly (deg C)

Niño Regions in the Tropical Pacific Ocean



Nino 3.4 – The principal region in the eastern tropical Pacific used by the Climate Prediction Center (CPC) for monitoring, assessing and predicting ENSO.



The average sea surface temperature anomaly (SSTa) for the NINO 3.4 region in the eastern tropical Pacific has risen in the past few weeks, a probable indication that the mature La Niña in the Pacific has begun to weaken.

The average SST anomaly for NINO 3.4 region for the week of Feb 14, 2011 was -1.2C.

Oceanic Niño Index (ONI)

- The ONI is based on sea surface temperature (SST) departures from average in the Niño 3.4 region of the Pacific and is a principal measure for monitoring, assessing, and predicting ENSO.

- Defined as the three-month running-mean SST departures in the Niño 3.4 region

- Used to place current events into a historical perspective

- NOAA's operational definitions of El Niño and La Niña are keyed to the ONI index.

NOAA Operational Definitions for El Niño and La Niña

El Niño: characterized by a ***positive*** ONI greater than or equal to +0.5 C.

La Niña: characterized by a ***negative*** ONI less than or equal to −0.5 C.

By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed +/- 0.5°C along with consistent atmospheric features. These anomalies must also be forecasted to persist for 3 consecutive months.

Oceanic Niño Index - ONI

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2000	-1.6	-1.4	-1	-0.8	-0.6	-0.5	-0.4	-0.4	-0.4	-0.5	-0.6	-0.7
2001	-0.6	-0.5	-0.4	-0.2	-0.1	0.1	0.2	0.2	0.1	0	-0.1	-0.1
2002	-0.1	0.1	0.2	0.4	0.7	0.8	0.9	1	1.1	1.3	1.5	1.4
2003	1.2	0.9	0.5	0.1	-0.1	0.1	0.4	0.5	0.6	0.5	0.6	0.4
2004	0.4	0.3	0.2	0.2	0.3	0.5	0.7	0.8	0.9	0.8	0.8	0.8
2005	0.7	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.2	-0.1	-0.4	-0.7
2006	-0.7	-0.6	-0.4	-0.1	0.1	0.2	0.3	0.5	0.6	0.9	1.1	1.1
2007	0.8	0.4	0.1	-0.1	-0.1	-0.1	-0.1	-0.4	-0.7	-1	-1.1	-1.3
2008	-1.4	-1.4	-1.1	-0.8	-0.6	-0.4	-0.1	0	0	0	-0.3	-0.6
2009	-0.8	-0.7	-0.5	-0.1	0.2	0.6	0.7	0.8	0.9	1.2	1.5	1.8
2010	1.7	1.5	1.2	0.8	0.3	-0.2	-0.6	-1.0	-1.3	-1.4	-1.4	-1.4

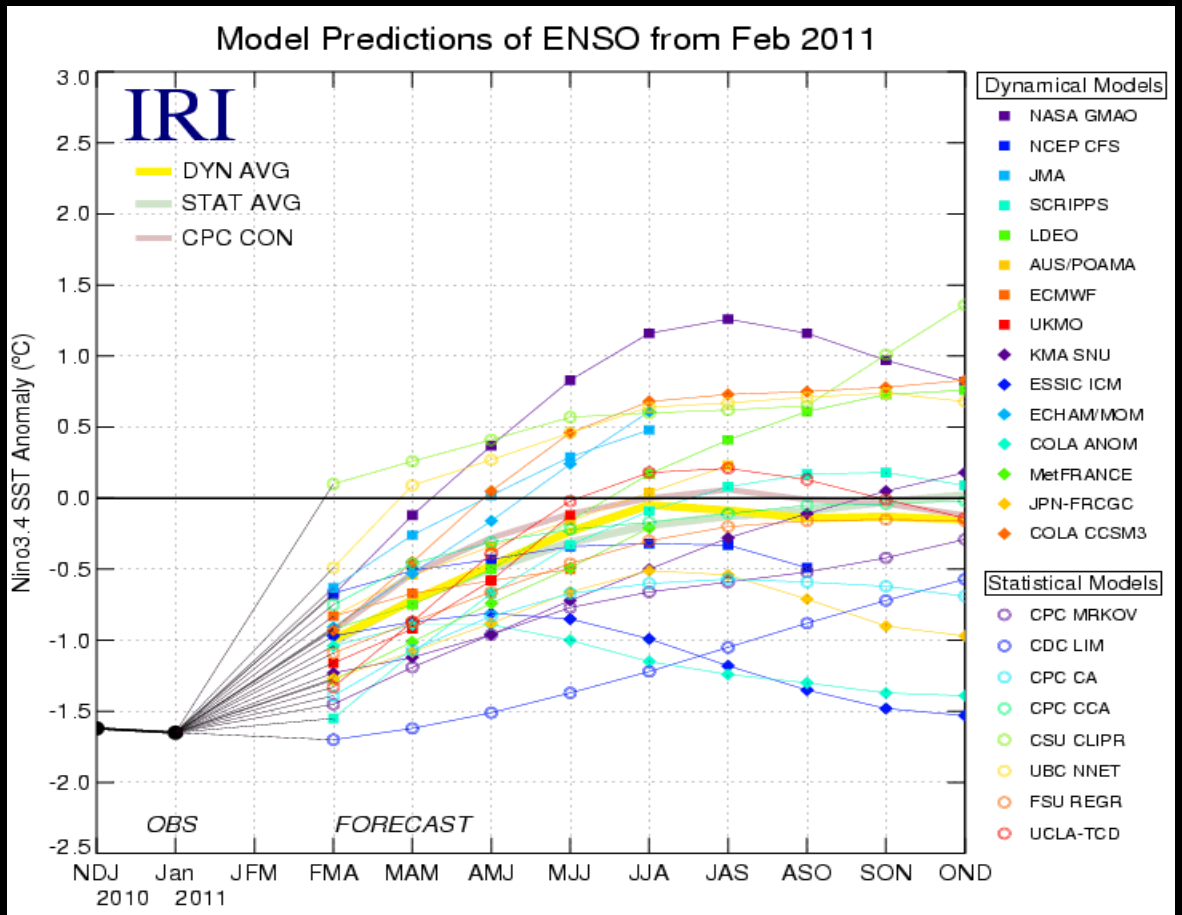
Warm Episodes - El Niños: ONI +0.5 and above (red numbers)

Cold Episodes - La Niñas: ONI of -0.5 and below (blue numbers)

Neutral or non-ENSO Episodes: ONI above -0.5 and below 0.5 (black numbers)

NOAA/CPC Feb 18 2011 Baker

Pacific Region Niño 3.4 ENSO Outlook



Average Sea Surface Temperature Anomalies for All Models for the following Three-Month Seasons in 2011

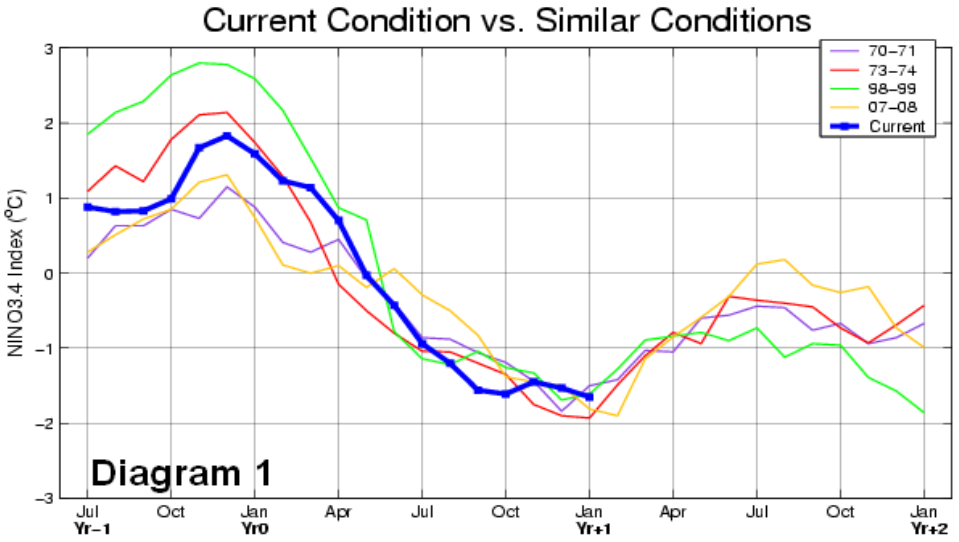
FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND
-1.0	-0.7	-0.5	-0.3	-0.1	-0.1	-0.1	-0.1	-0.1

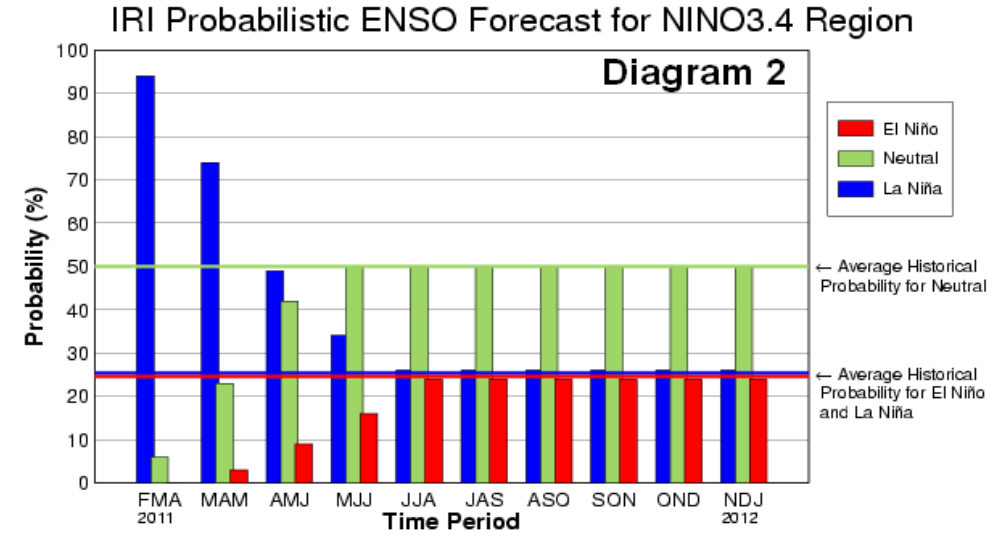
- **All 23 dynamical and statistical ENSO models continue to forecast gradual warming of the SST anomalies across the eastern tropical Pacific region Niño 3.4 during the next several months. A majority of the models indicate either ENSO-neutral (+0.5 C to -0.5 C) or weak La Niña (-0.5 C to -1.0˚C) conditions by the three-month climate season May-June-July of 2011.**

- **Beyond this spring, the models offer a wide range of possibilities, with some indicating a return to La Niña, while others indicate ENSO-neutral conditions or even the start of an El Niño as early as August or September.**

Source: International Research Institute for Climate and Society (IRI) – Updated 2/17/11

La Ninas Past, Present and Future





Source: International Research Institute for Climate and Society (IRI)
Updated Feb. 17, 2011

Diagram 1: Is a comparison of the Niño 3.4 Index for the current La Niña and the past four moderate to strong La Niña episodes of 1970-71, 1973-74, 1998-99 and 2007-08.

Compare the weakening (warming) in the Index observed this past December to the strengthening (cooling) in the Index for the same time period during the other four La Niña winters. During two of these winters cooling in the Index continued into January, similar to that observed during this past January.

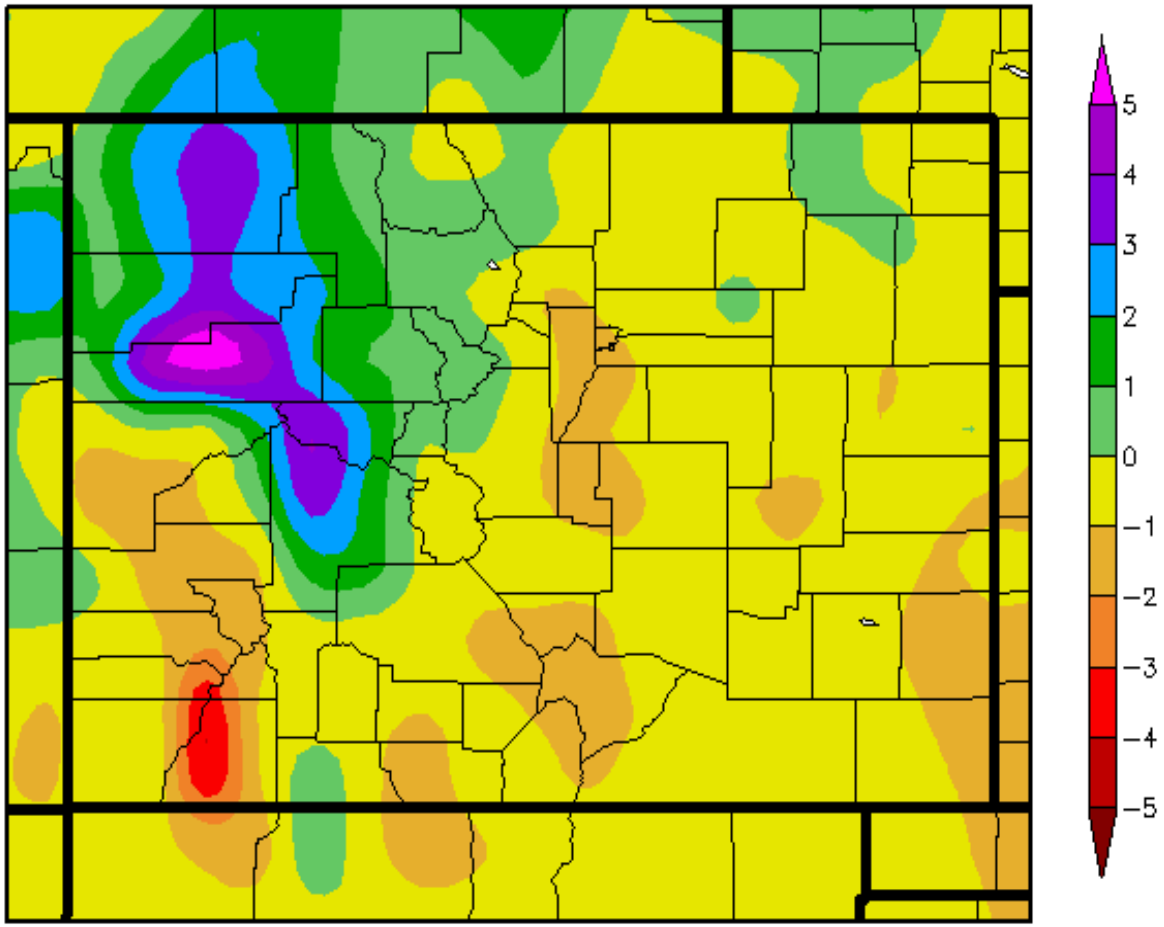
Diagram 2: The bar graph depicts the probability of El Niño, La Niña and ENSO-neutral or non-ENSO conditions during the next 12 months, based on the latest ENSO model forecasts.

By the summer season of June-July-August, models indicate equal chances for La Niña and El Niño conditions, with no clear preference towards warming or cooling in the SSTs during the remainder of 2011.


Look Back to
the Last 90 Days
Winter 2010-2011
on the Colorado Western Slope

90-Day Review of Temperature, Precipitation, Snow Pack and Snow-Water Equivalency Across Colorado

Departure from Normal Preciptation (in inches)
For Colorado
Nov. 1, 2010 - Jan. 31, 2011

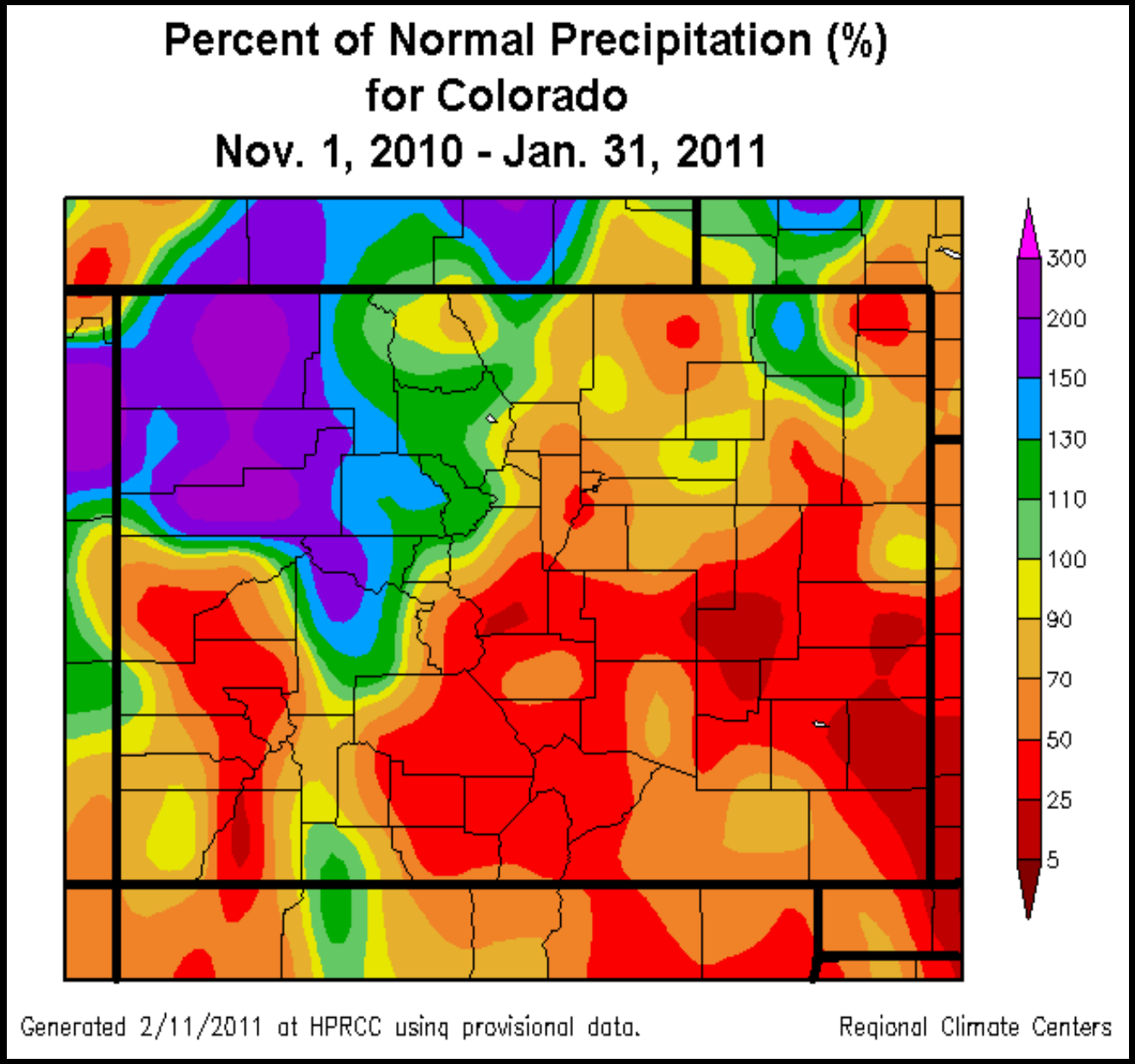


Generated 2/11/2011 at HPRCC using provisional data.

Regional Climate Centers

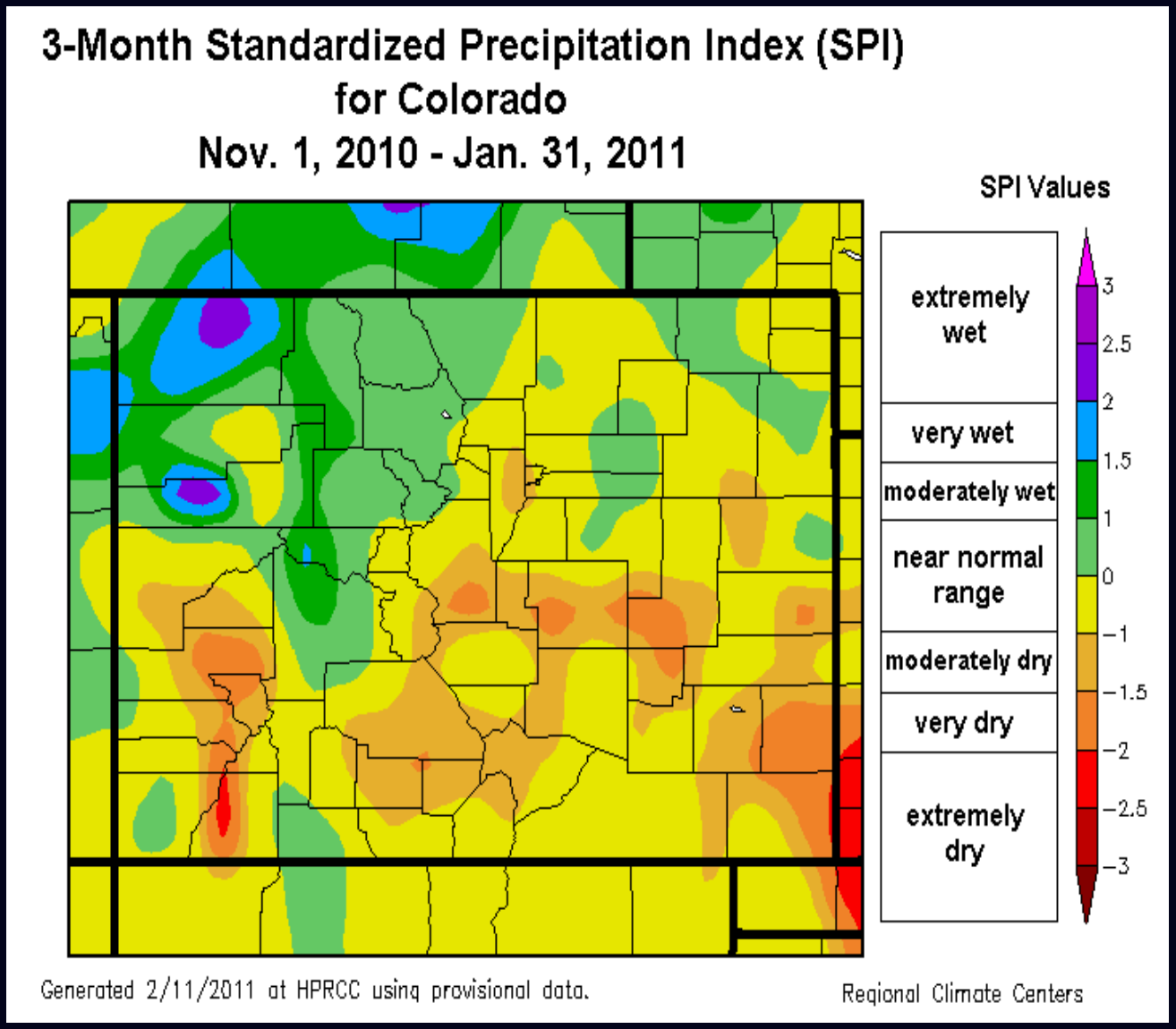
Above normal precipitation fell across much of northwest and west central Colorado during this three month period, with the greatest departures from normal on the Roan Plateau, Grand Mesa, the West Elk Mountains and central portions of the Yampa River Valley.

Below normal precipitation fell across southern and eastern Colorado during the same period. The greatest departures were observed in and around the Animas and Gunnison River Valleys in southwest Colorado, the Sangre de Cristo and Rampart mountain ranges, and lower portions of the Arkansas River Valley in southeast Colorado.



The northwest corner of Colorado continued to record the greatest percent of normal precipitation during the three month period as indicated by the shades of purple across the region.

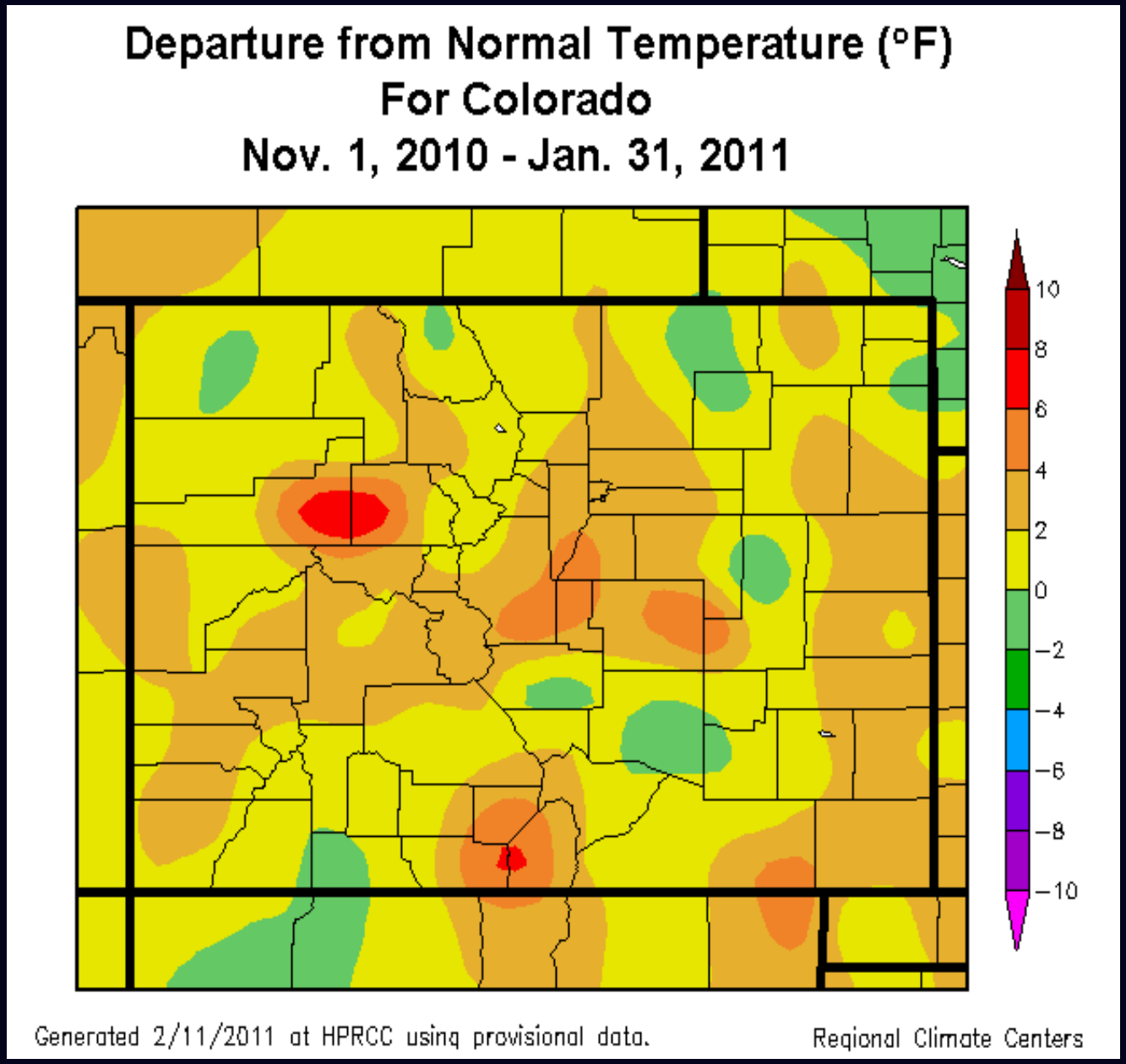
The remainder of the state witnessed modest to significant departures from normal, notably across the southwest, south central and southeast portions of Colorado. This cross-state pattern of precipitation anomalies can be attributed to the prevalence of west-northwesterly flow aloft this winter.



The **Standardized Precipitation Index (SPI)** was developed to monitor potential short term agricultural and long-term hydrological drought conditions. The SPI is a probability index that considers only precipitation.

During the 90-day period ending January 31, 2011, the SPI continued to indicate wetter than normal conditions across the northwest, west central and north central portions of the state. The driest conditions persisted in the southwest, the Rio Grande Valley and on the plains of eastern Colorado, most noticeably within the Arkansas River Basin.

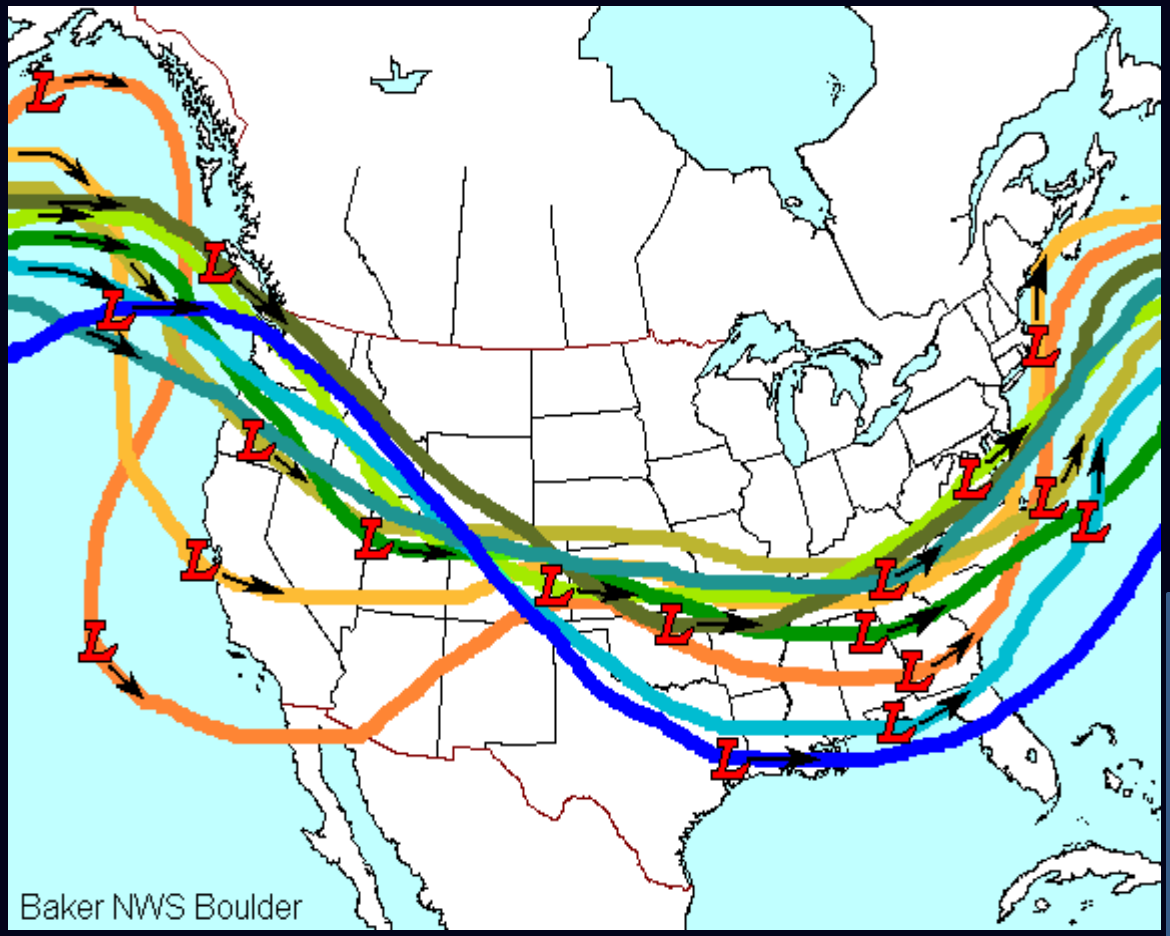
The copious amounts of snow that fell on southwest Colorado and especially the San Juan Mountains during the latter half of December only raised the SPI to within the near normal range. Before the heavy snowfall arrived the region was abnormally dry and warm.



Temperatures during the 90-day period ending January 31, 2011 were generally above normal across the state, with a few exceptions on the eastern plains, the San Juan Mountains near the New Mexico border, North Park and the northwest plateau region.

Warmest readings were observed along the Park and Gore Ranges, and most notably the White River Plateau region in northwest Colorado, over higher elevations of central Colorado, the San Luis Valley in south central Colorado, and most of eastern Colorado including the Rampart and Front Ranges, the Palmer Divide and across the southeast corner of the state.

Average Weekly Trajectories of the Pacific Jet Stream From Late November 2010 to Mid-January 2011



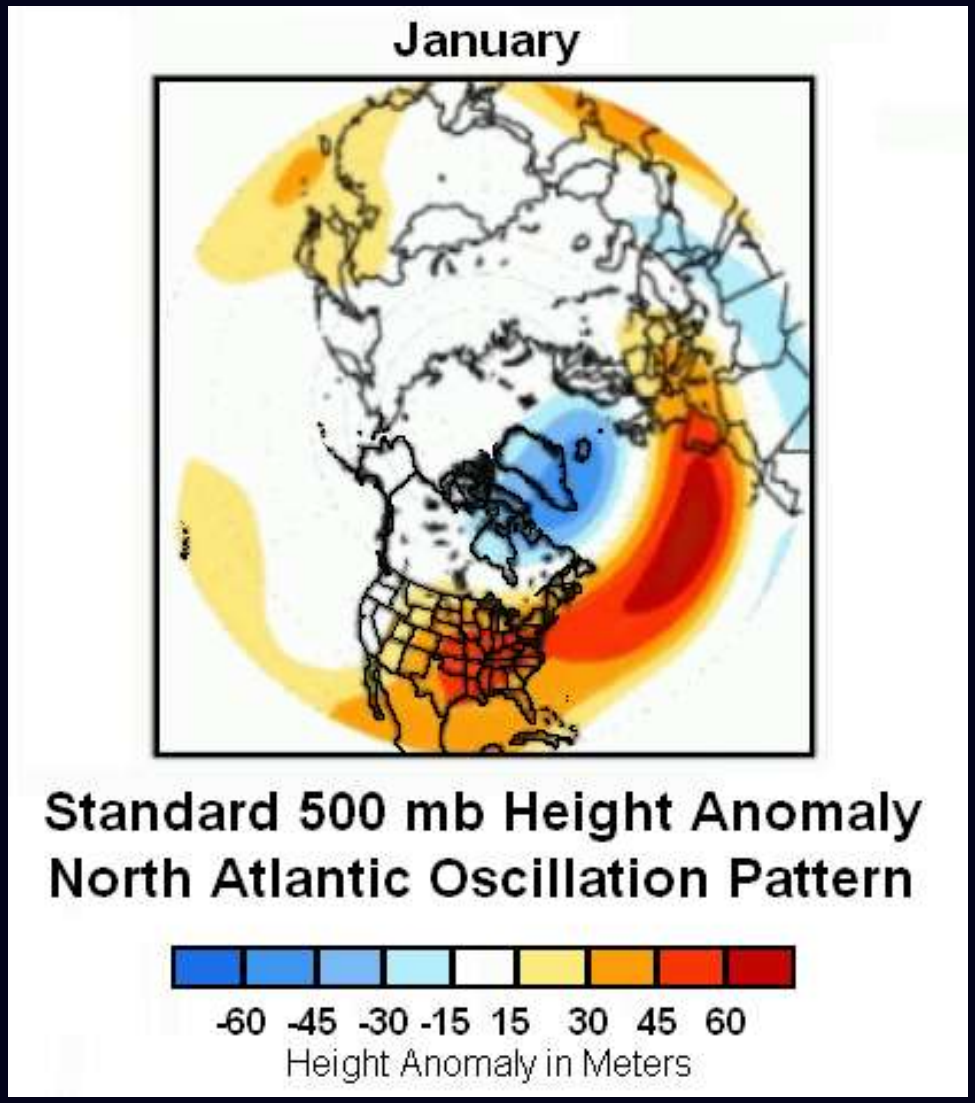
1) The Pacific jet stream played an important role in producing the wide variety of intensity weather across the continental United States this winter. Strong ridging out west and deep troughing over the eastern U.S. prevailed during most of November through January; a height and jet stream pattern commonly observed during La Niña episodes.

2) However, in late December, this simple sine wave pattern broke down. Arching well up over the Gulf of Alaska then sharply down the west coast, an abnormally strong Pacific jet stream carved out a large trough of low pressure that remained over the southwestern U.S. for nearly two weeks. These west coast oscillations in the Pacific jet tend to occur more often during the winter seasons of El Niño episodes.

3) The unexpected buckle in the Pacific jet stream (e.g., storm track) this past December resulted in record breaking rain and snowfall, coastal flooding and fierce winds across central and southern California, the desert southwest, and the Four Corners region including southwestern portions of Colorado.

The North Atlantic Oscillation (NAO)

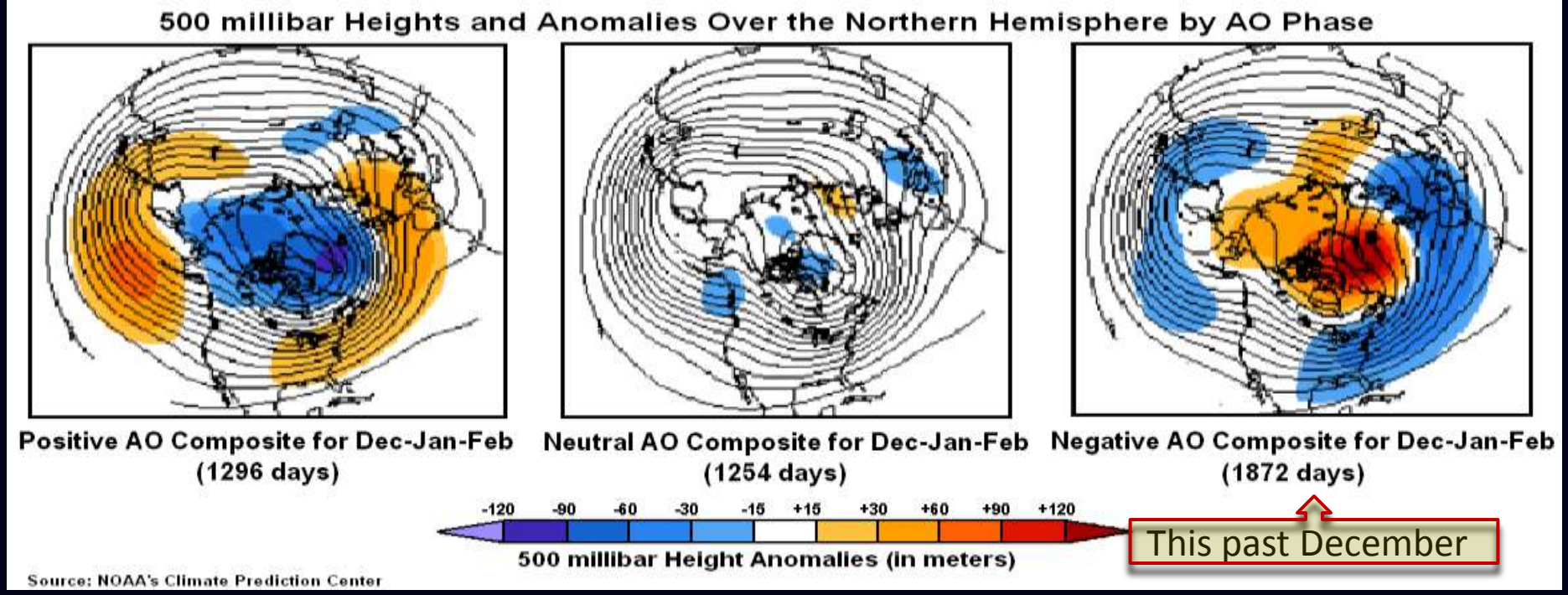
The Role it May Have Played in the Wild Weather on the West Slope in December



The North Atlantic Oscillation (NAO) is an interseasonal manifestation of the atmosphere over the northern and central Atlantic Ocean. Oscillations in pressure and geopotential heights produce potentially large fluctuations in surface wind, temperature and precipitation patterns across the north Atlantic region, western Europe and, at times, across eastern portions of North America.

NAOs rarely last longer than a few weeks and are more prevalent during the colder winter months.

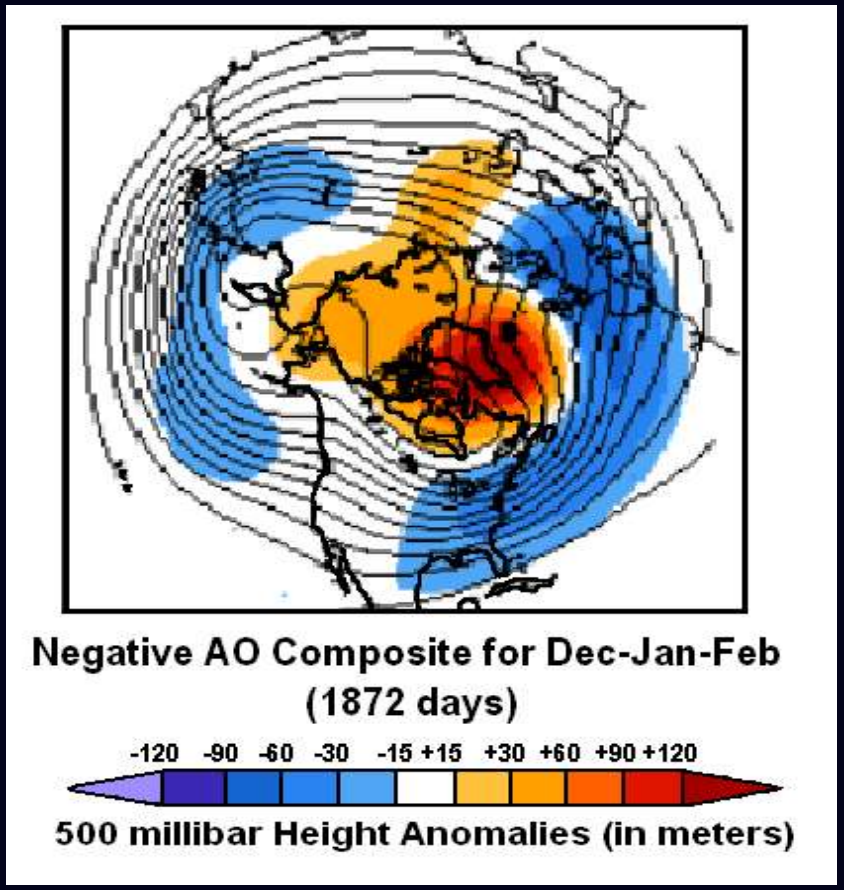
An abnormally strong AO developed over the north Atlantic early this winter. As strong as it was, could it have affected weather patterns as far away as the western continental United States?



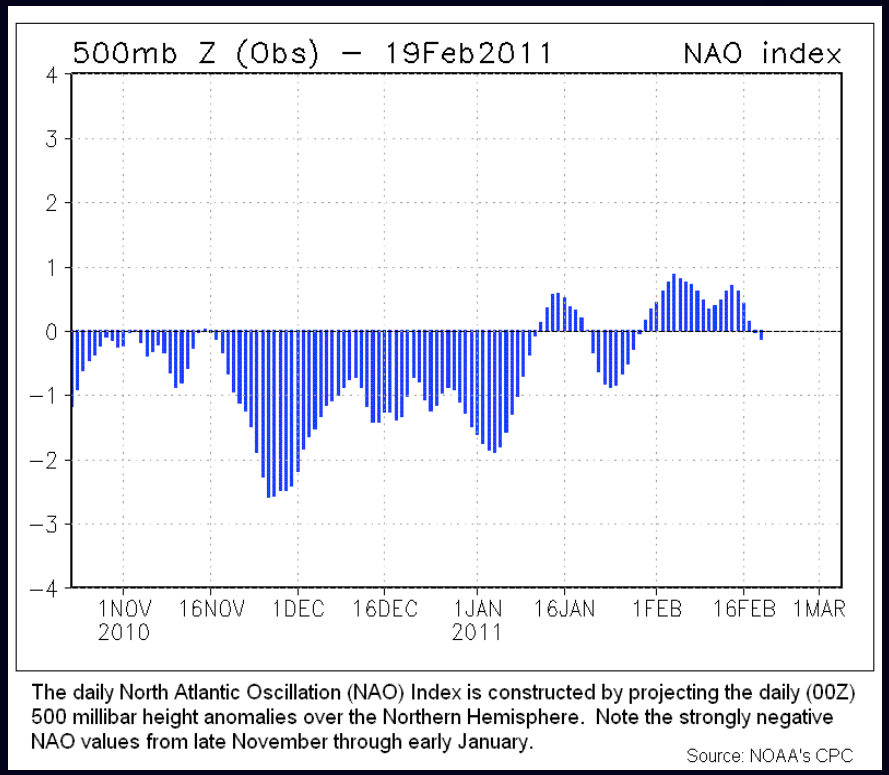
Under +AO conditions, below average geopotential heights associated with a stronger than normal Polar Vortex exist over the Arctic, Iceland, Greenland, the north Atlantic and as far west as Alaska; while above average heights are commonly observed over the central Atlantic and eastern United States. A strong surface pressure gradient between the Icelandic Low and Azore High also produces greater than normal westerly wind speeds across the Atlantic and eastern portions of the U.S., conditions also observed when El Niño conditions exist in the Pacific Ocean.

Under neutral AO conditions, near normal geopotential heights are generally observed across the Northern Hemisphere. The surface pressure gradient between the Icelandic Low and Azore High also remains generally weak, resulting in lighter than average wind speeds across the north Atlantic Basin. Flatter (weaker) upper level ridges also persist over western portions of North America and Europe, with flat upper level troughs over eastern portions of North America and the northern and western Atlantic Basin.

Under -AO conditions, above average heights due to a weaker than normal Polar Vortex, are found over the Arctic, Iceland, Greenland, northern Canada and the north Atlantic; while below average heights exist over the central Atlantic, western Europe and the eastern U.S.. Meanwhile strong upper level high pressure ridges develop and persist along the west coast of North America. This anomalous height pattern appeared in late last December with an unusually strong ridge over Alaska and western Canada producing abnormally warm and dry conditions in the region.



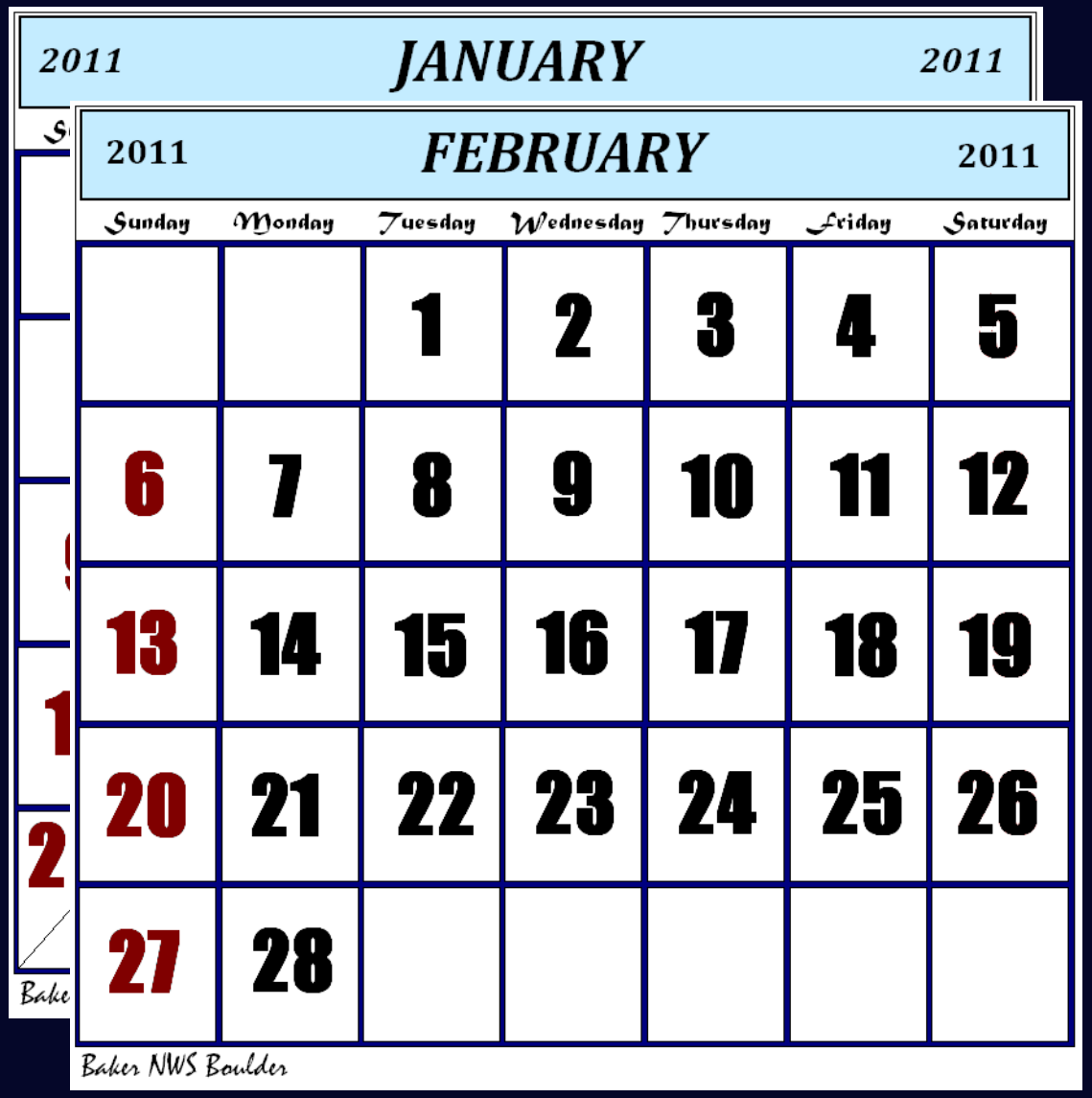
North Atlantic Oscillation Index (NAO) from late October 2010 to mid-February 2011



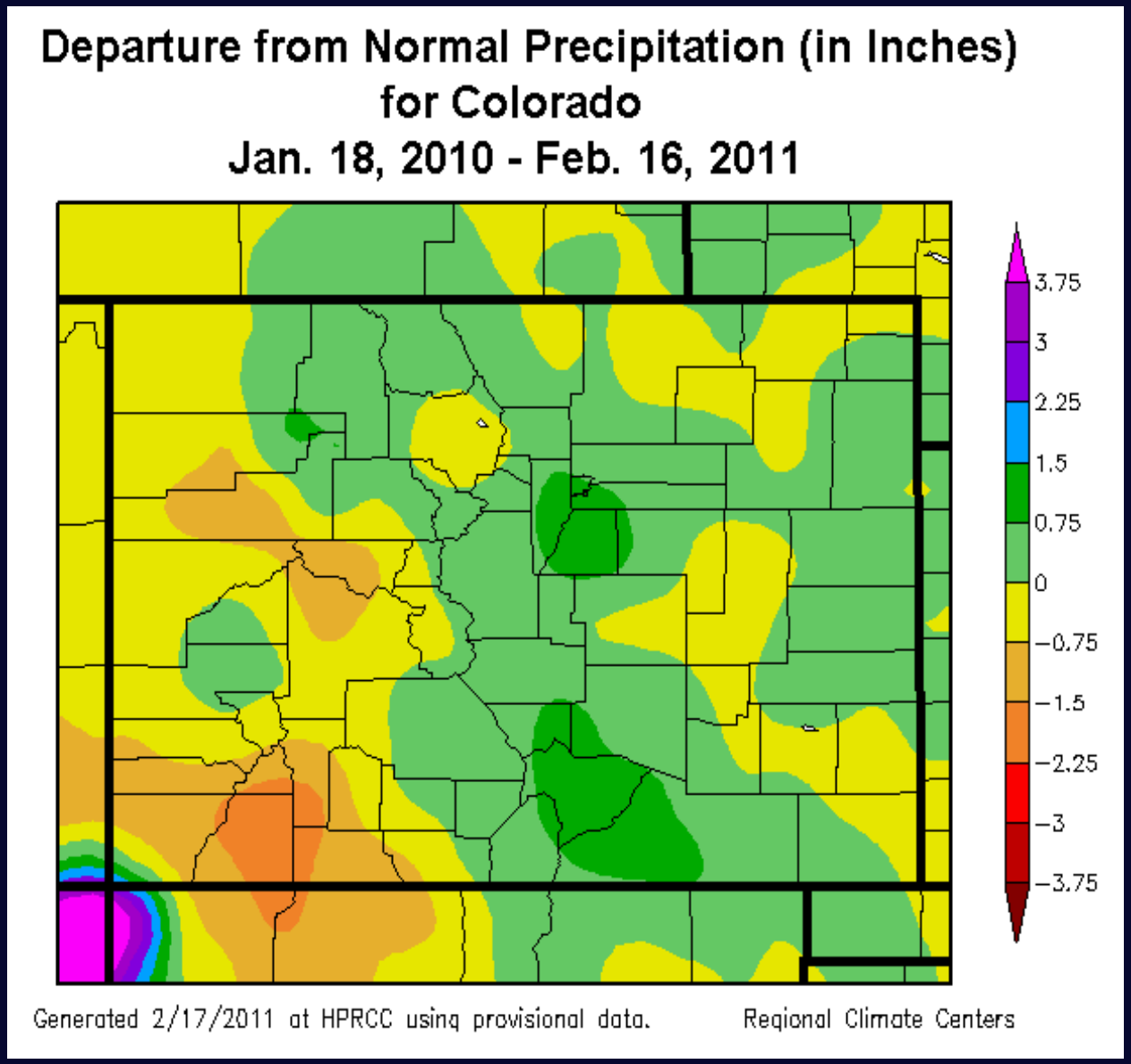
The daily North Atlantic Oscillation (NAO) Index is constructed by projecting the daily (00Z) 500 millibar height anomalies over the Northern Hemisphere. Note the strongly negative NAO values from late November through early January.

Source: NOAA's CPC

The abnormally strong high pressure ridge that formed over Alaska and northwest Canada in December coincided with exceptionally low NAO values across the north Atlantic (see daily NAO values in the upper right). At the same time, northern and western Europe, southeastern Canada and eastern portions of the United States experienced some of the coldest air on record, together with frequent bouts of strong winds and heavy snowfall. These hostile conditions may have been produced by an abnormally large eastward shift in the Icelandic Low which allowed extraordinarily cold air to stream down from the Polar region. An even greater southward shift in the Polar Vortex also created a “block” in the atmosphere which possibly caused the Pacific jet stream to sharply buckle, forming the deep low pressure system that produced the record snowfall and gale force winds across southwestern Colorado late last December.

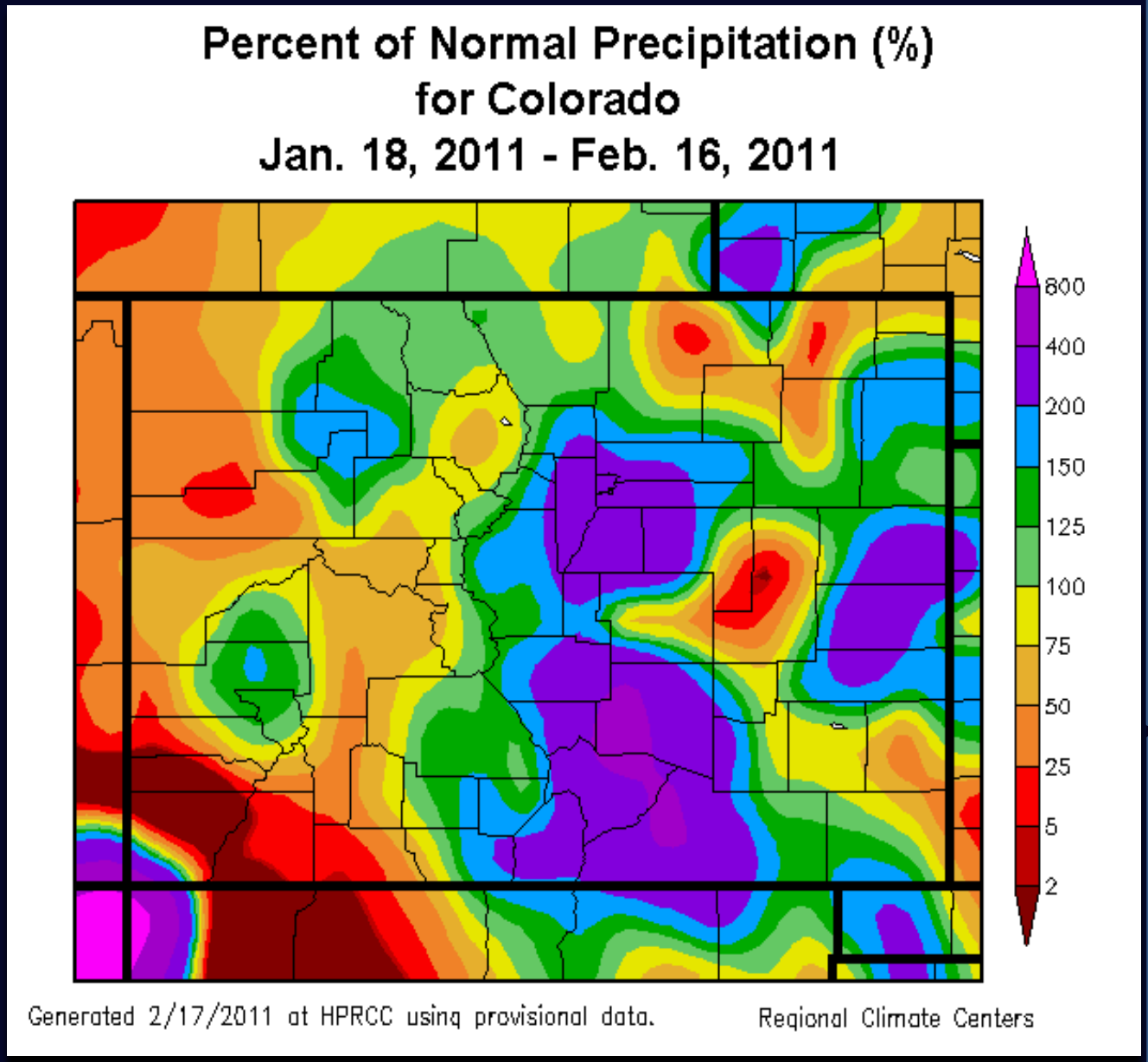


30-Day Review of Temperature, Precipitation, Snow Pack and Snow-Water Equivalency Across Colorado



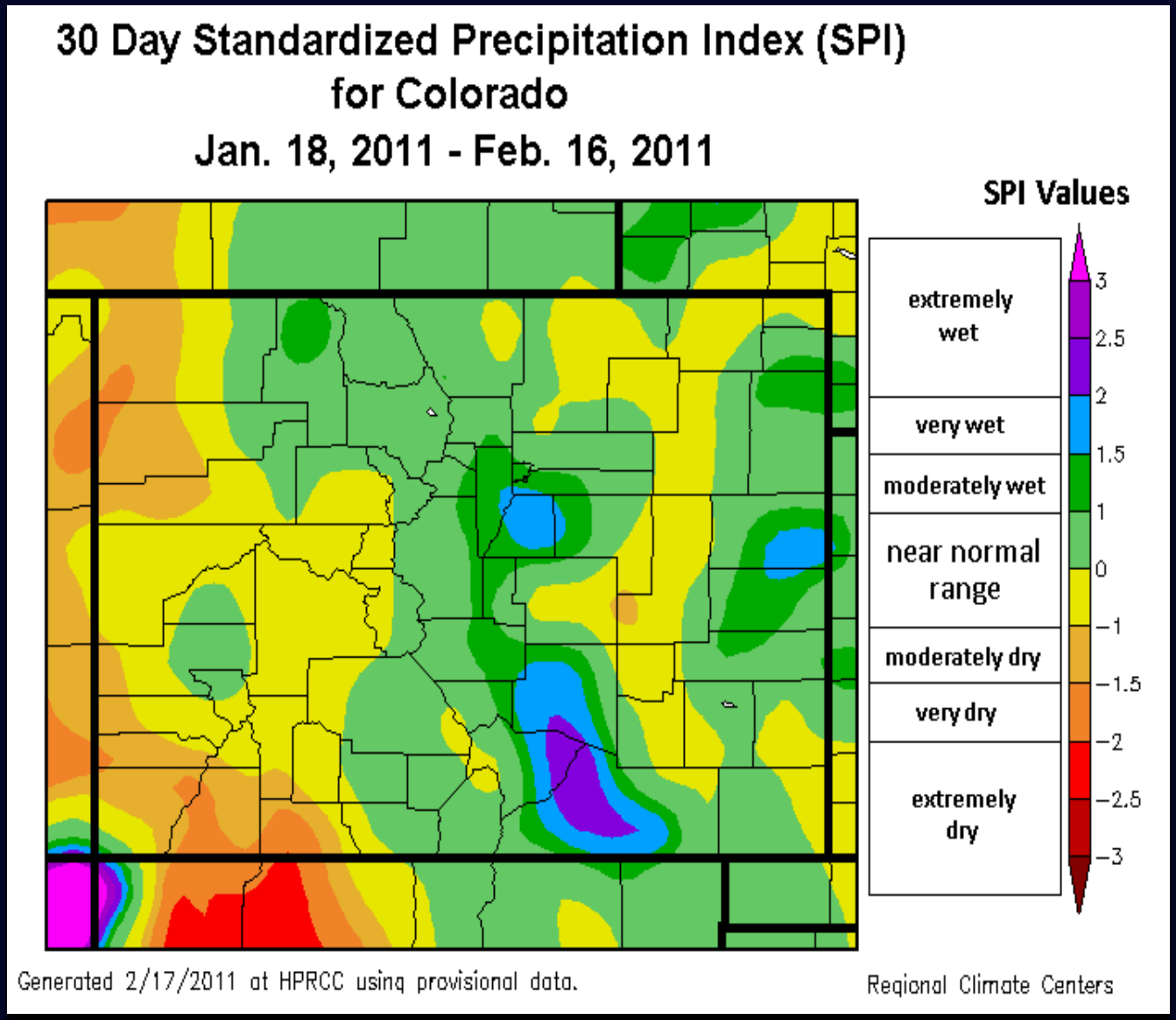
Colorado saw a significant shift in the distribution of precipitation during this 30-day period. As the Pacific jet stream winds became more northerly in orientation, aligning with much stronger Polar jet stream over the Great Plains, precipitation baring cold fronts swept down out of eastern Montana and across eastern Colorado on at least three occasions. These fast moving frontal systems each produced several hours of moderate to heavy snowfall along the Front Range, over the Palmer Divide, and down along the east slope of the Sangre de Cristo Mountains and north side of the Raton Ridge in southern Colorado.

The western slope saw a drop-off in snowfall with the greatest departures in precipitation in the southwest mountains.



Precipitation varied from 200 to 400 percent above normal on the higher terrain south and west of Denver, the Denver Metro area, areas near the Kansas border, and on and near the Sangre de Cristo and Wet Mountain ranges in southern Colorado. East and northeast facing slopes of the Wet Mountains southwest of Pueblo saw precipitation totals exceeding 400 percent of normal.

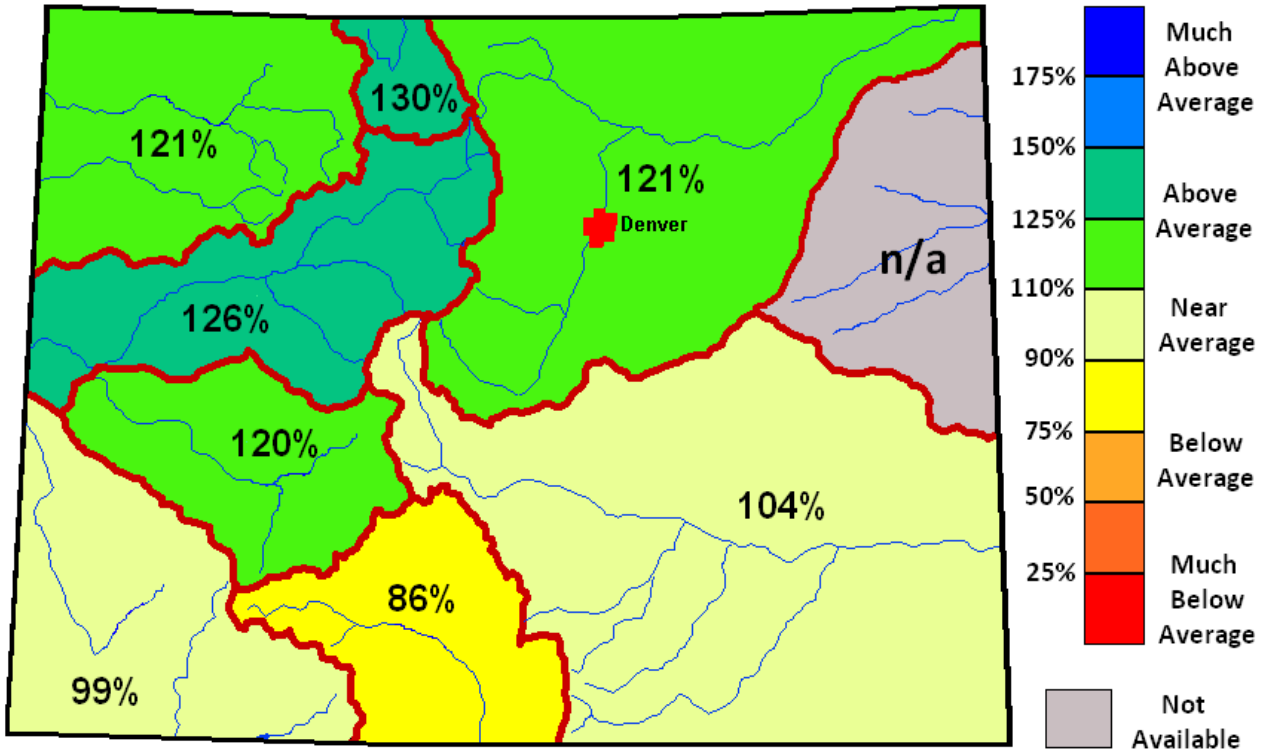
The greatest month-to-month change in precipitation occurred across portions of northwest and west central Colorado, largely due to the directional shift in the Pacific jet stream.



During the 30 day period ending February 16, 2011, the SPI indicated wetter than normal conditions along the spine of the Rocky Mountains, parts of the northwest and the eastern plains. The most significant improvement in moisture levels appeared over and along the eastern slopes of the Front Range, Rampart Range, Wet and Sangre de Cristo Mountains and Raton Ridge near the New Mexico border.

The northwest plateau dried out and the southwest saw little, if any, improvement in moisture levels from the previous month.

Snow Water Equivalent as a Percent of Average (%) for Colorado by River Basin as of Thursday, February 17, 2011



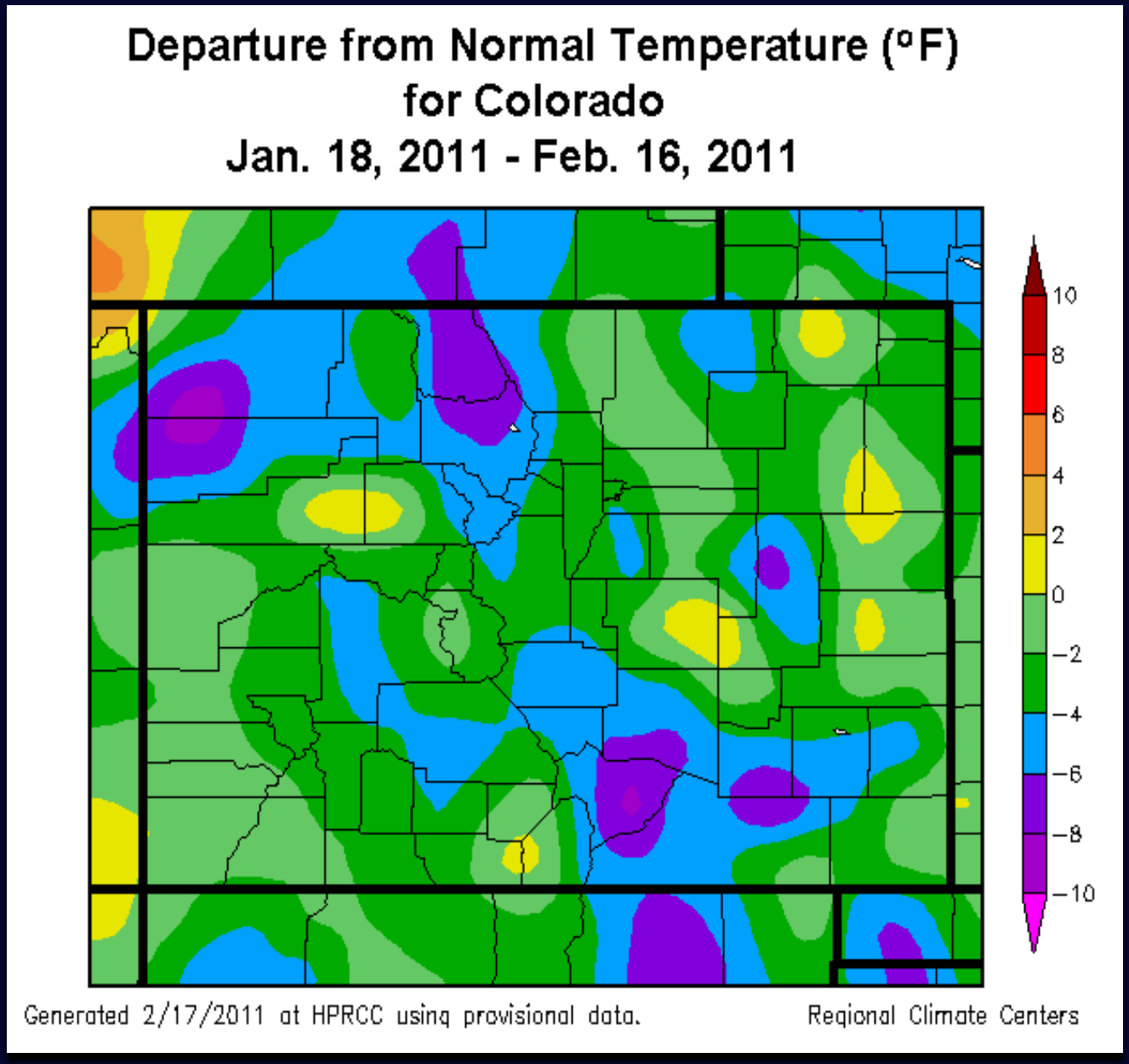
Basin Wide Percent of Average (%)

WEST SLOPE		EAST SLOPE	
Yampa and White River Basins	121%	South Platte River Basin	121%
Upper Colorado River Basin	126%	Arkansas River Basin	104%
Gunnison River Basin	120%		
San Migual, Dolores, Animas & San Juan River Basins	99%	Statewide Avg....115%	
Upper Rio Grande Basin	86%		

Source: USDA Natural Resources Conservation Service--Water and Climate, Portland, Oregon
provisional data, subject to revision

Snow Water Equivalents decreased in the river basins of northwest and west central Colorado during the 30-day interval, while basins on the east slope saw only a slight increase.

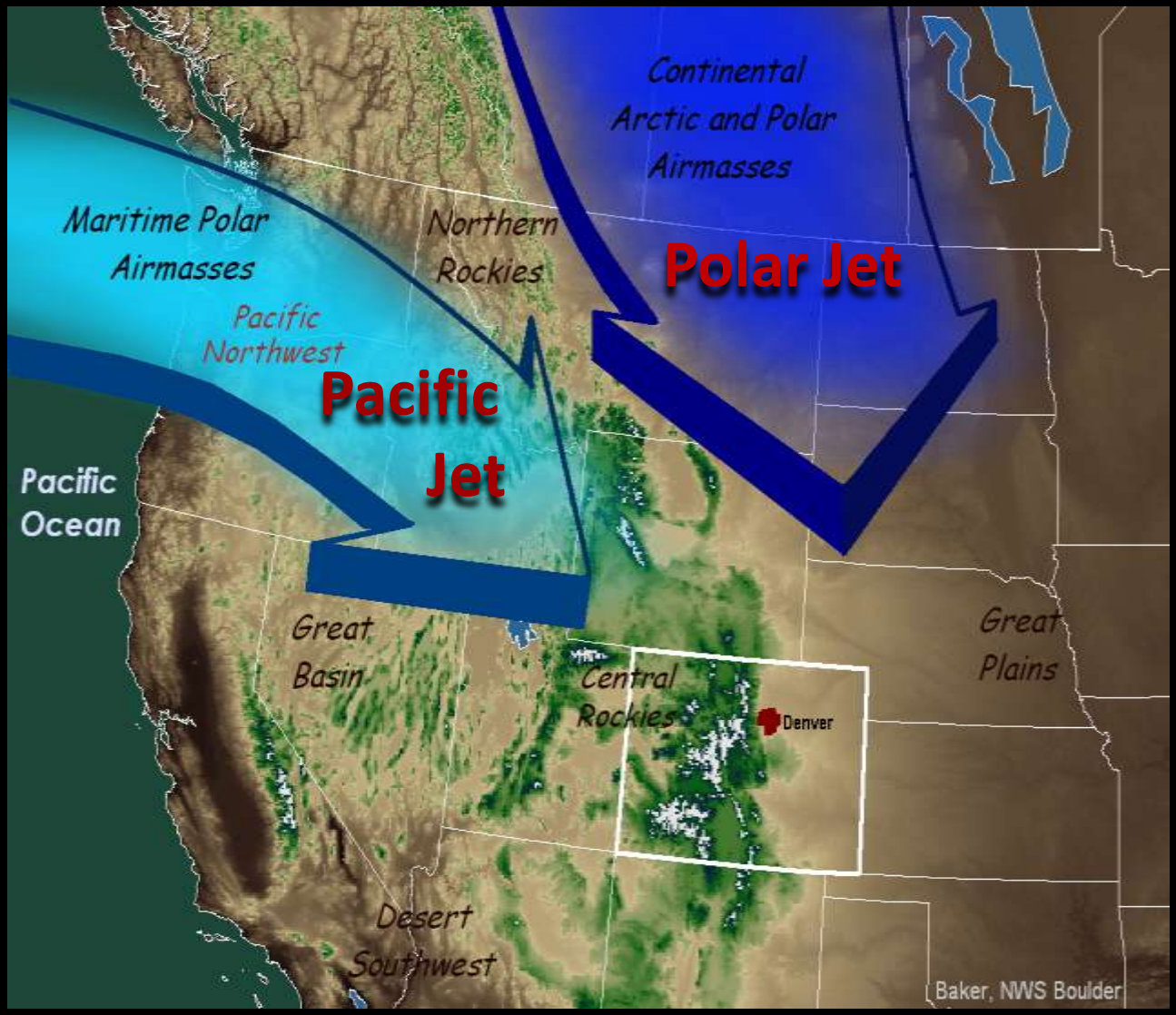
River basins in the southwest and south central portions of Colorado continued to see a reduction in snow water equivalents during the period.



Temperatures during the 30-day period ending February 16, 2011, reversed course and became significantly colder across Colorado, especially across northern and eastern portions of the state. The southwest managed to escape these onslaughts of arctic air. The arrival of these bitterly cold arctic air masses in January and early February drove daily temperatures downward by as much as 25 to 40 degrees F below normal, mainly across northern and eastern portions of Colorado.

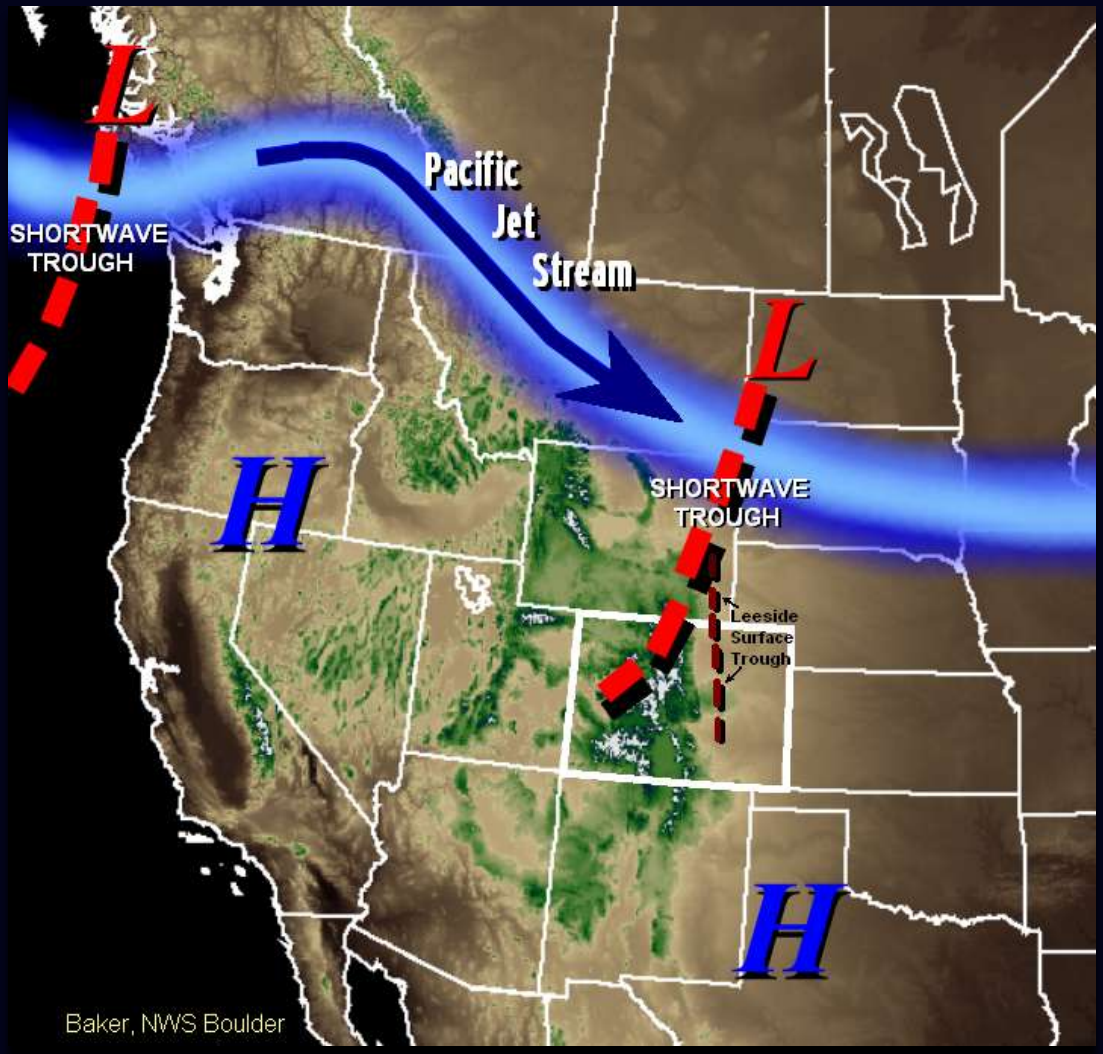
A Weakening La Niña and a Shifting Jet Stream – How They May Continue to Influence Colorado Weather During March, April and May of 2011

Changes in the Prevailing Jet Stream Pattern Over the Western U.S.



As we move toward spring, the Polar and Pacific jet streams will begin to shift northward to higher latitudes as the northern hemisphere warms with the increasing angle of sun's direct rays.

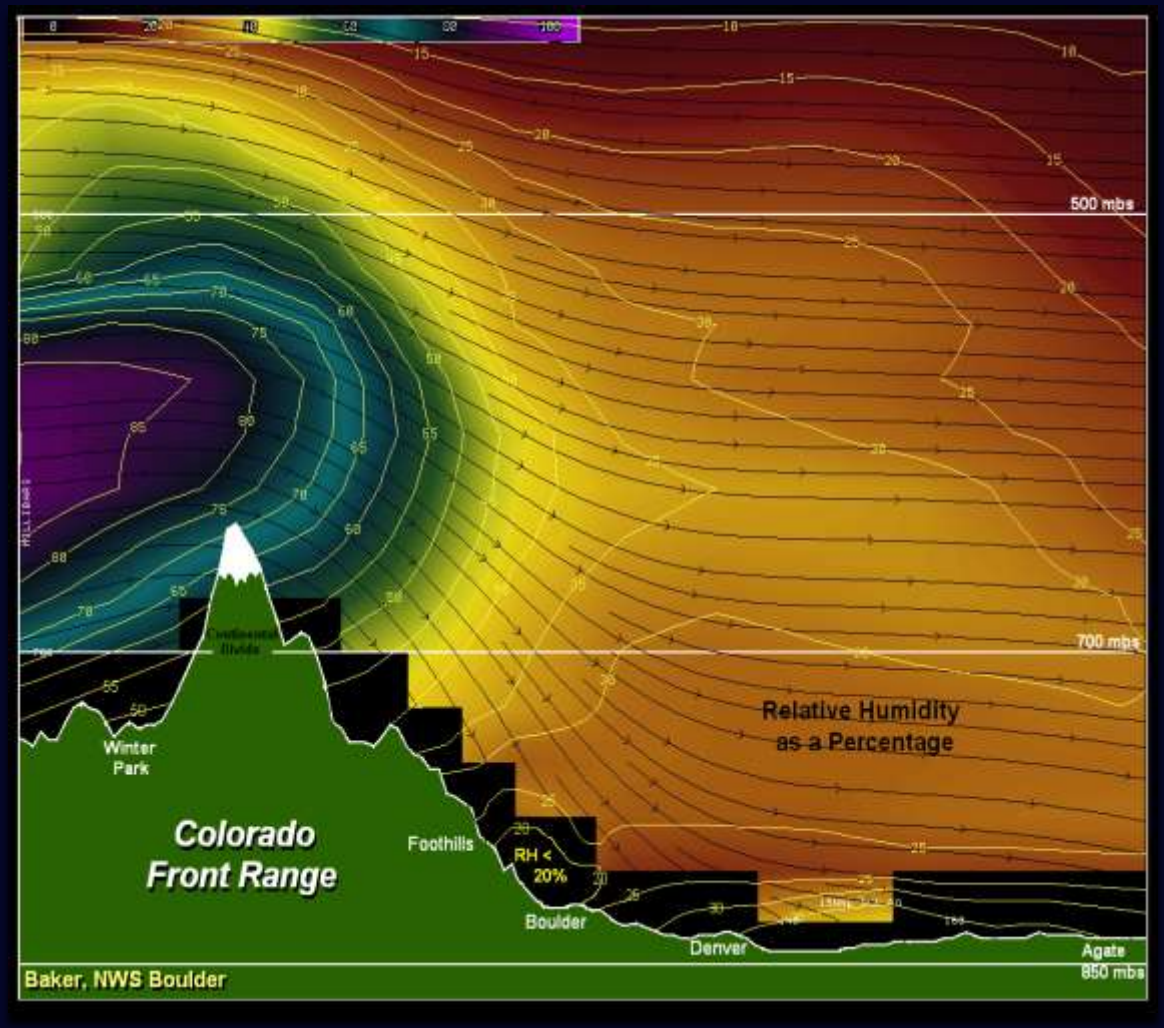
The Pacific Jet Stream and Its Seasonal Shift Northward



As La Niña weakens, so too will the Pacific jet stream as it slowly migrates northward with increased daylight and warming temperatures.

However, the influence of La Niña and the Pacific jet stream on Colorado weather will probably not go away soon - even as we transition into springtime.

Waves of energy, or troughs of low pressure, carried along by the Pacific jet stream will pass more to the north of Colorado in the weeks to come. Even so, Colorado will continue to feel the effects of the Pacific jet. Northern mountain areas in Colorado should continue to see periods of moderate to heavy snowfall and strong wind at least through March, while east of the mountains drier and warmer than normal conditions can be expected with periods of gusty, and possibly damaging downslope winds.



Areas experiencing downslope winds, particularly warm and gusty Chinook winds, will often see the lowest relatively humidities.

Relative humidity values can fall to below 5 percent in the windier areas near the foot of the Colorado Front Range and be as much as 30 percent lower than values in nearby areas experiencing less wind.

These desiccating downslope winds often play a critical role in the enhancement and spread of **wildland fire**.

Potential Critical Weather Impacts Along the Colorado Front Range During the Final Days of La Niña

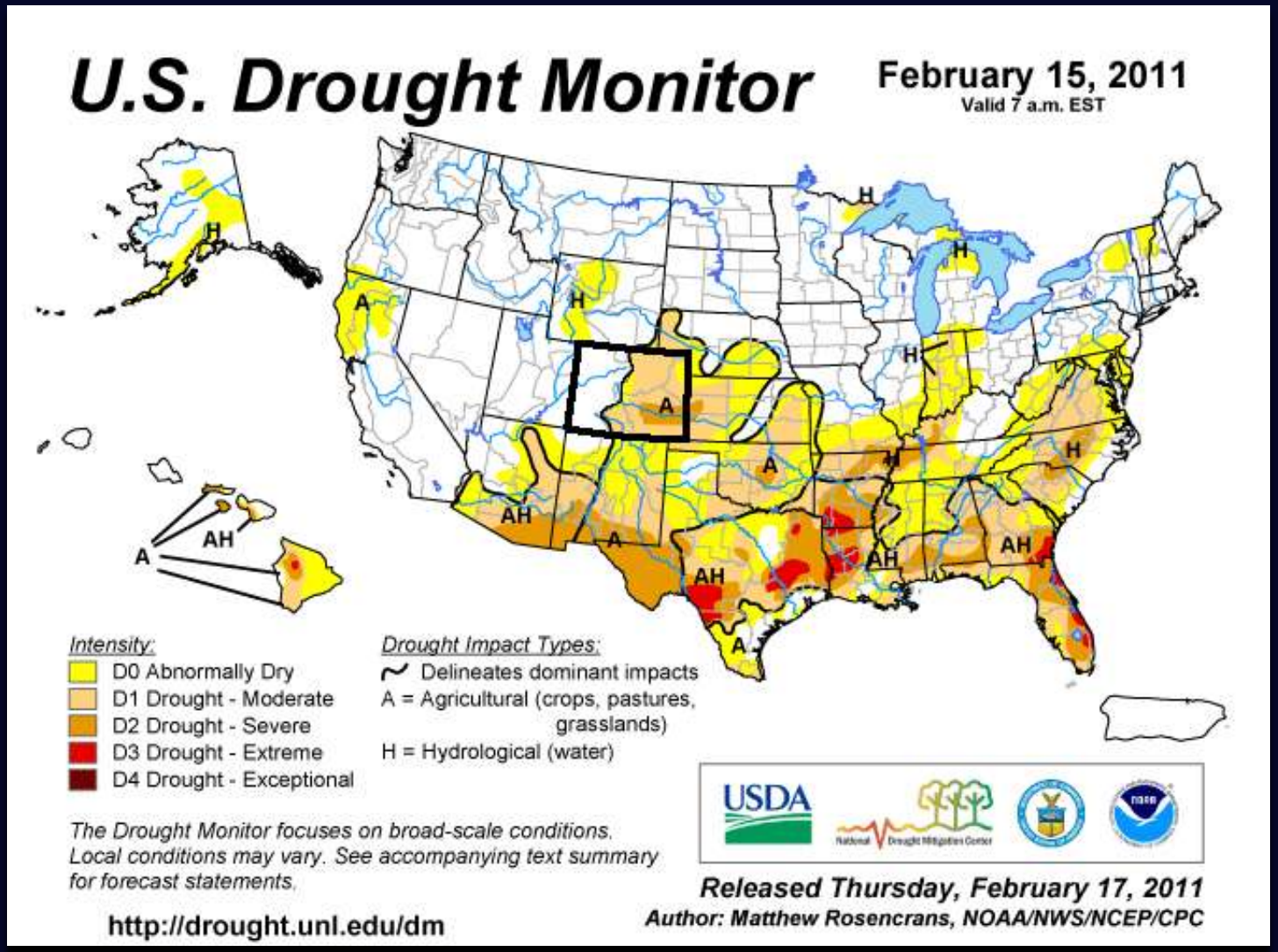
Record Heat

Abnormally Dry Conditions Leading to Regional Drought

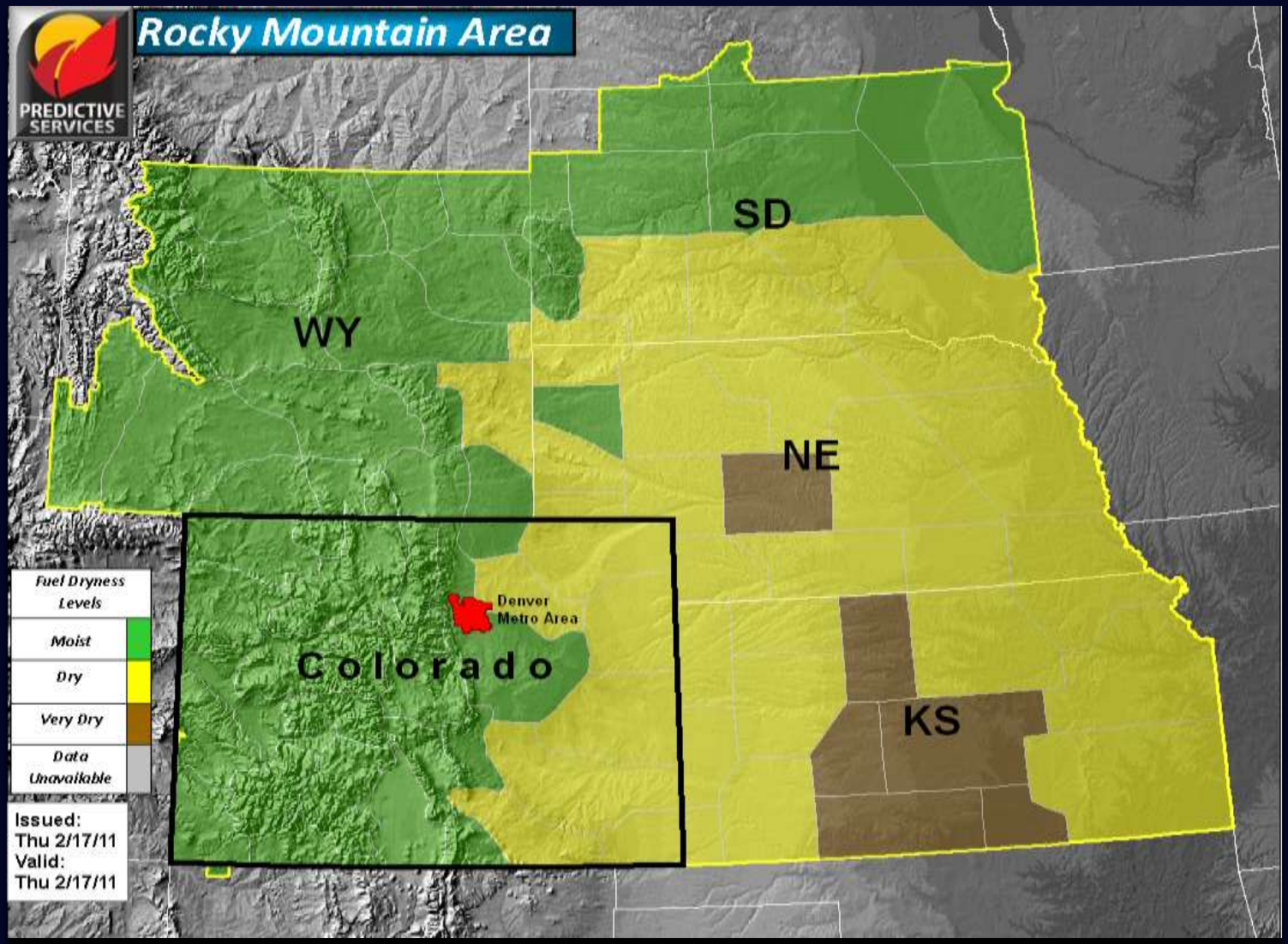
Reduced Runoff To Area Lakes and Reservoirs

A Growing Risk of Wildland Fires

Strong and Potentially Damaging Downslope Wind Storms



The U.S. Drought Monitor indicates that moderate to severe drought conditions affecting agricultural activities in eastern Colorado exist as of February 15, 2011.



Fuels such as short and tall grasses and shrubs have already begun to dry out across eastern Colorado with the recent warm and windy conditions. As of the middle of February, Predictive Services in Boise, Idaho indicated dry fuels on the plains of eastern Colorado. Otherwise fuels were determined to be moist over the remainder of the state.

Seasonal Significant Wildland Fire Potential Outlook – March to May 2011

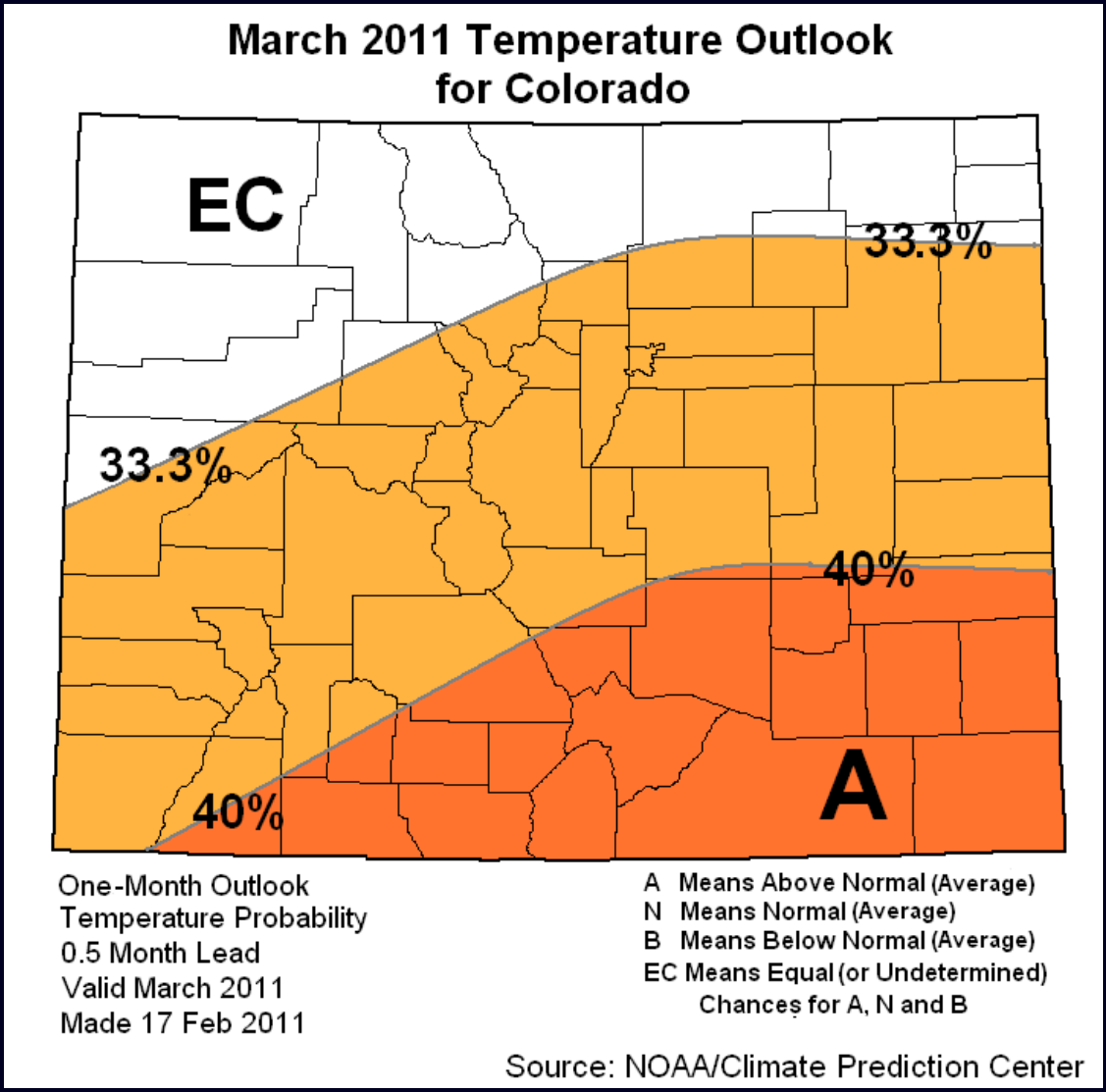
Significant fire potential is the likelihood that a wildland fire event will require mobilization of additional resources from outside the area in which the fire situation originates.

Predictive Services at the National Interagency Coordination Center in Boise, Idaho predicts that southeast Colorado will see the potential for significant wildland fire increasing to above normal during the upcoming spring.

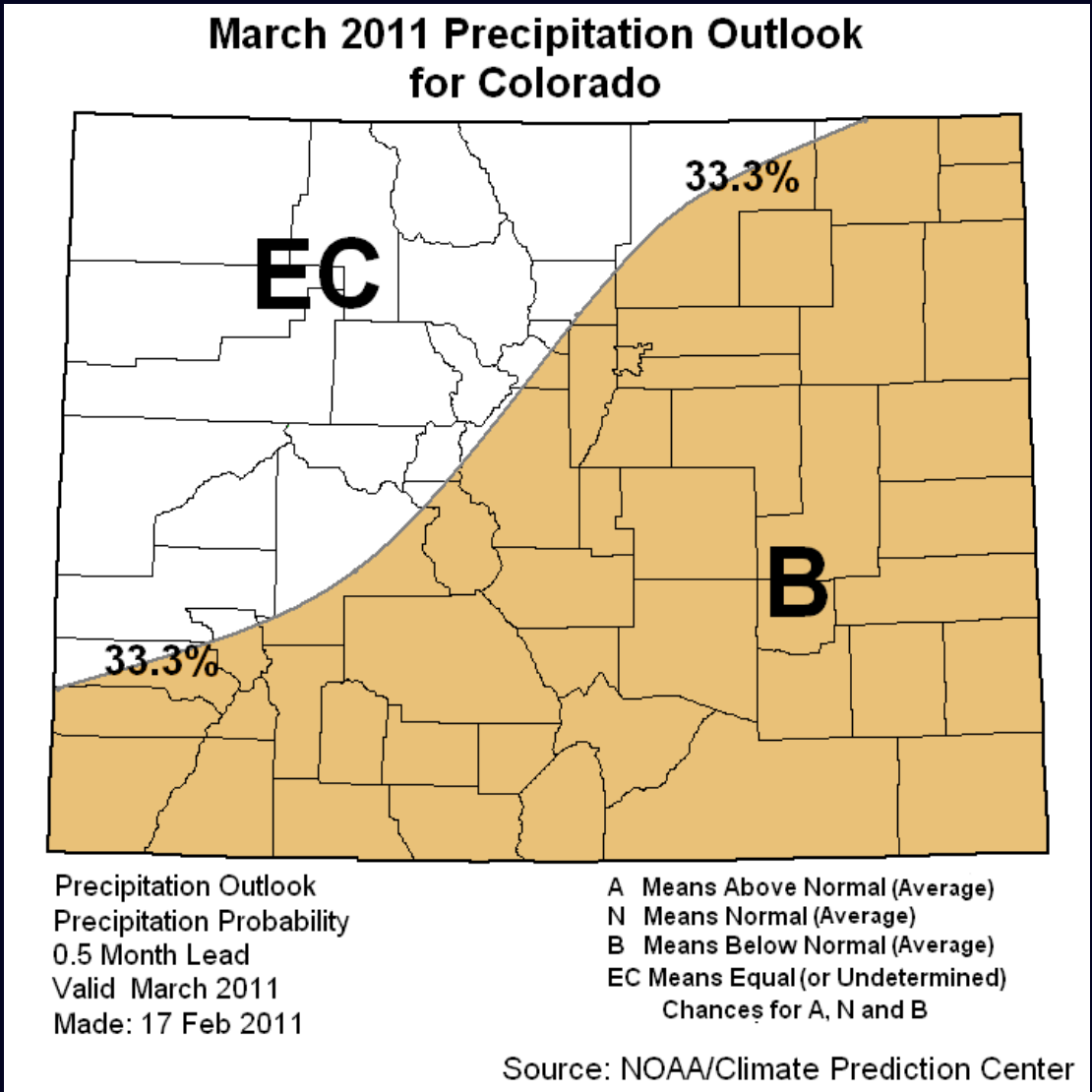
Other parts of Colorado, such as the northeast plains and the San Luis Valley, could also see an increase in wildland fire potential during this period; a condition brought on an extended period of abnormally warm temperatures and very low humidity, gusty downslope winds and little or no precipitation.

Map produced by
Predictive Services,
National Interagency
Coordination Center
Boise, Idaho
Issued February 1, 2011
Next issuance March 1, 2011

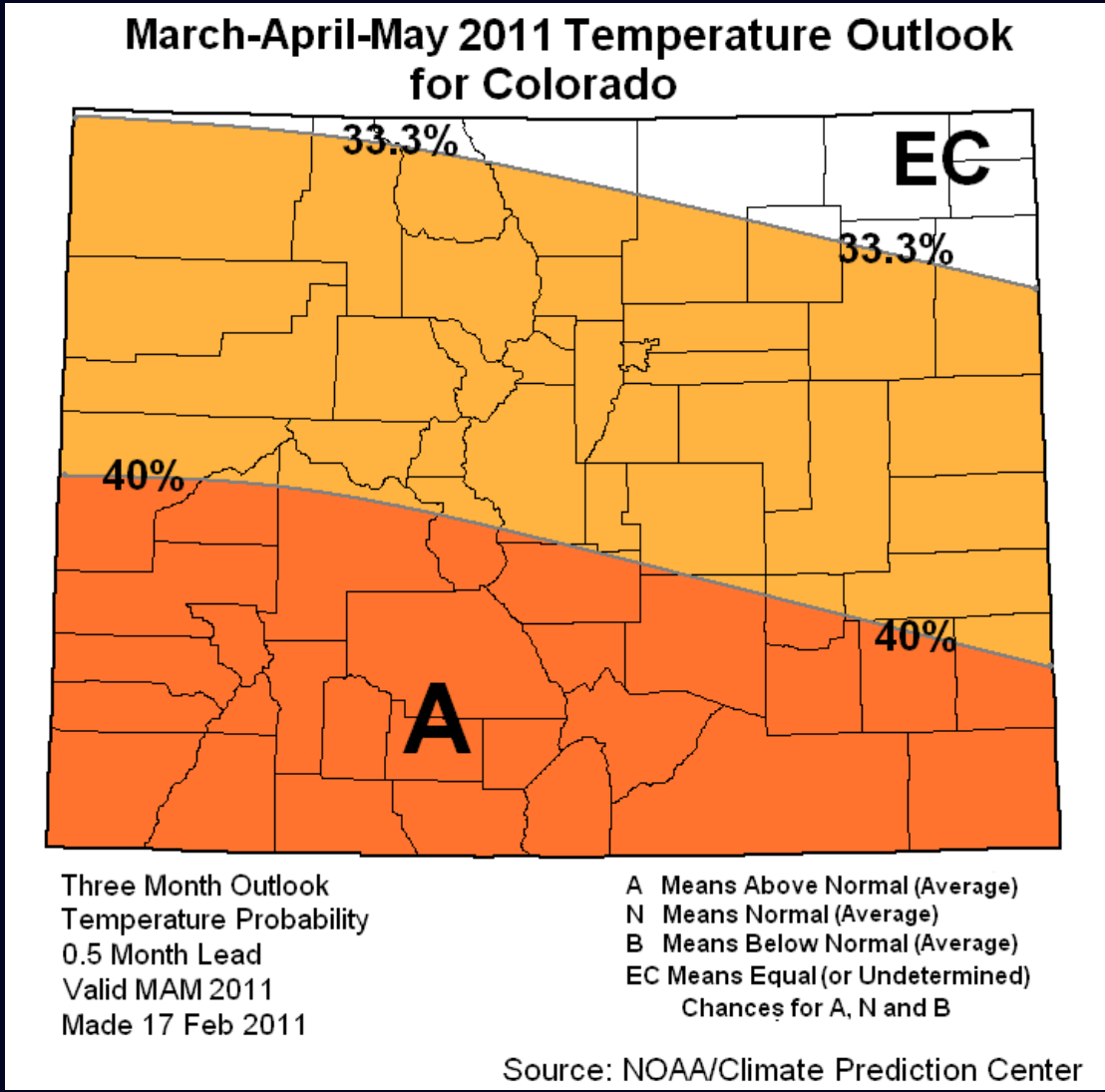
Temperature and Precipitation Outlooks
For March-April-May 2011
Issued by NOAA's
Climate Prediction Center



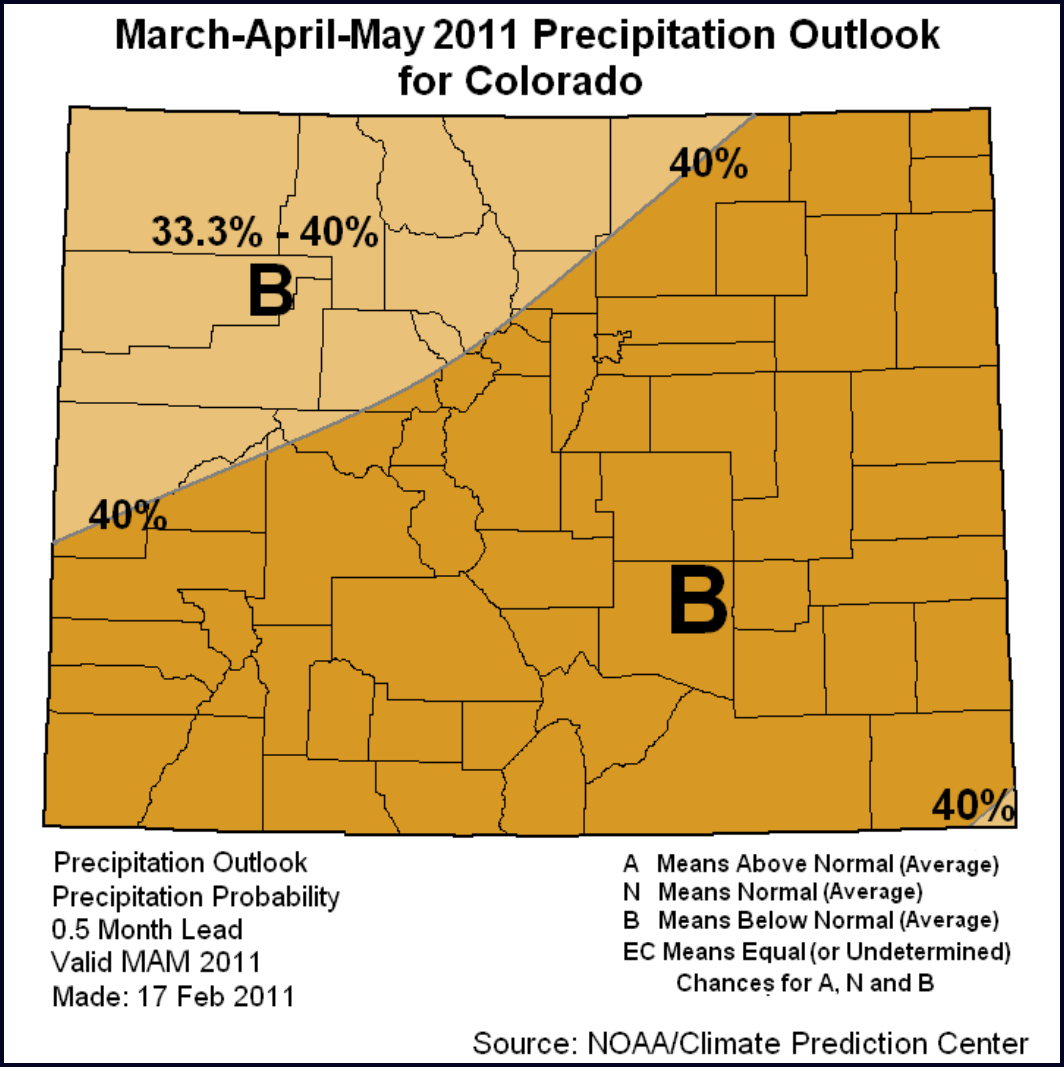
For March, there is at least a 40% probability for below normal (average) precipitation across southeast and south central portions of Colorado, a 33.3 to 40% probability for below average precipitation across central portions of the state, and an equal or undetermined chance for above, below or near normal precipitation across the northwest corner of Colorado.



For March, there is a 33.3 to 40% probability for below normal (average) precipitation across southern and eastern portions of Colorado, and an equal or undetermined chance for above, below or near normal (average) precipitation across the northwest corner of the state.



For March, April and May, there is at least a 40 percent probability for above normal (average) temperatures across roughly the southern one-third of Colorado, a 33.3 to 40 percent probability for above normal (average) temperatures across the remainder of the state, except across the far northeast corner of the state where there is an equal or undetermined chance for above, below or near normal (average) temperatures.



For March, April and May, there is at least a 40 percent probability for below normal (average) precipitation across the southeast two-thirds of Colorado, and a 33.3 to 40 percent probability for below normal (average) precipitation across the remaining one-third of the state as well as the extreme southeast corner of Colorado.

Summary and Conclusions

- Negative sea surface temperature anomalies (SSTa) indicative of a mature La Niña have begun to weaken across the central and eastern tropical Pacific Ocean.

- This recent trend in SSTa and the latest forecasts from nearly two dozen ENSO-climate models indicate an equal chance for ENSO-neutral and weak La Niña conditions in the tropical Pacific Ocean by late this spring.

- If La Niña should continue to weaken as forecasted, it is likely that it will continue influence, to some degree, weather patterns across Colorado and the western United States well into this spring.

- The latest outlook from the Climate Prediction Center (CPC) indicates that most of Colorado has better than a 33 percent chance for above normal (average) temperatures and below normal (average) precipitation during the months of March, April and May of 2011.